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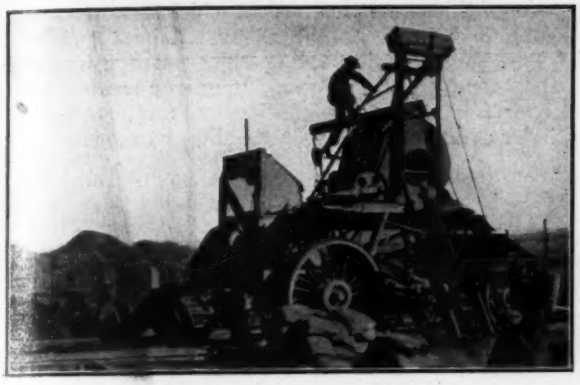

Motor-Driven Concrete Mixer.

Six-Inch Portable Pump, Electrically Driven.

Construction of Famous Aqueduct Faciliated by Electricity

Use of Motor-Operated Machinery Effects Considerable Saving in Construction Costs as Well as Speeding Operations

By C. W. GEIGER

SINCE the completion, recently, of the famous Los Angeles Aqueduct, an opportunity has been afforded to determine the economies resulting from the use of electricity in the construction of this important project. It is interesting to note, in this connection, that the cost of supplying electric power proved to be within 2.5 per cent of the original estimates. The original estimates of the cost of power supply by other means was much higher and the experience of the engineers proved electric power to be much more desirable even at the same cost because of its reliability and adaptability.

A tabulation of the connected load at one time in service between the aqueduct intake and the Pinto Hills shows the character of the electric power service required in construction.

MOTOR INSTALLATION INTAKE TO PINTO HILLS.

		Horsepower.
2	suction dredges	400
1	dipper dredge, 1½-yard dipper	100
4	electric shovels, ¾-yard dippers	300
	Tufa regrinding mill	200
	Haiwee Dam, hydraulic work	100
8	air compressors	800
8	motor-generators, 80 kw. each	1000
7	rock crushers, 10 to 20 tons per hour each	140
28	concrete mixers	280
7	blowers	70
3	hoists	60
2	pumps	20
	Total rated capacity of motors	3470

The connected load due to lighting, machine shop motors and other such small requirements is not tabulated.

The use of portable outdoor type transformer banks was adopted even for the supplying of units as low as from 5 to 10 horsepower, in preference to the use of gas engines.

The employment of experienced linemen for patrolling and maintaining the lines and connecting and disconecting transformer banks resulted in economy and efficiency. In the operation of the high-voltage power systems during the five years of aqueduct construction, no employe connected with the system was hurt by electricity.

The power was supplied from three sources, as follows: The Southern California Edison Company; the steam plant at the cement mill, consisting of two 750 kva. turbine units; and from three hydroelectric plants built along the aqueduct line.

There were two independent systems of distribution for power along the aqueduct. The first, known as the Saugus system, extended from the south end of Fernando Tunnel to the Fairmont Tufa Mill, and was connected with the Castaic substation of the Southern California Edison Company, making a total of approximately 40 miles of 30,000-volt transmission, having connected to it step-down transformer stations, consisting of 75-kw., 40-kw. and 125-kw., 30,000-volt transformers, stepping down to either 440 or 220 volts, as may be desired, 440 volts being practically universal.

The second power system, known as the Cottonwood system, extends from the intake along the line

Large Electric Drum for Aerial Tramway.

of the aqueduct to the Pinto Hills, a distance of approximately 147 miles, and from the Pinto Hills 17 miles west to the cement plant, making in all, with branches connecting the three power plants, approximately 166 miles of 30,000-volt transmission. One hundred and forty-six miles of line consists of three No. 4 copper wires and seven-inch, two-part porcelain insulators on 30-foot poles, the remaining 20 miles being of No. 2 copper wire. Branches to transformer stations, aggregating some 12 miles, were constructed of No. 6 copper wire on 25-foot poles.

The Cottonwood system is supplied by three hydroelectric plants, Division Creek No. 1, 125 kw.; Division Creek No. 2, 600 kw., and Cottonwood Creek power plant, 1500 kw. rated capacity, with 25 per cent continuous overload capacity. These plants run in parallel with the cement plant steam station. This supplements the steam plant, which at certain times was insufficient, and adds to the stability and flexibility of the whole power system, and results in a saving of fuel oil at times during the day when there would otherwise be an excess of hydroelectric power. The hydroelectric power plants are of a permanent character.

Dredges Operated by Electric Motor.

The first 23 miles of the aqueduct, starting at the intake, was excavated by means of floating dredges operated by electric motors. There were two types of dredges used, known as suction and dipper dredges. The suction dredges cut the opposing bank with a hydraulic jet and the material disintegrated by cutters, operated by an independent electric motor of 30 h. p. Directly back of the cutters is the suction pipe coupled to a 12-inch centrifugal pump, belted to a 75 h. p. electric motor which delivers the muck on either side of the aqueduct to the spoil banks. Transformers and cable reels are carried on floats, towed in the rear. This type of dredges was employed until a deposit of limestone was struck, which required heavy blasting and could not be excavated by the suction dredges. An electric floating dipper dredge was then used to complete the section. It proved so efficient in its operation that it was decided to complete the remainder of the 23 miles with the dipper dredge.

Portable Electric Power Plant Used in Construction of Aqueduct.

Electrically Operated Pumps Used in Construction of Dam.

The North Haiwee dam was built in greater part by hydraulic method. Water was piped to the dam site, where it was picked up and discharged by a jeting pump of 100 lbs. pressure to the square inch, through hydraulic nozzles against an earthen bank. The water and material thus washed down were run to a concrete sump, and next picked up by a mud pump and discharged through a 12-inch pipe line to the dam. The jetting pump was of the centrifugal type with a ten-inch suction, and operated by a 100 h. p. electric motor; the mud pump had a 12-inch suction, and was operated with two 100 h. p. electric motors.

Electric Shovel Used on Aqueduct.

Practically all of the rock tunnels were driven with machine drills. Central air compressor stations were built, which delivered air at 100 pounds pressure per square inch. The compressors were belt-driven by electric motors.

Electric Locomotives Used for Tunnel Construction.

Electric locomotives were used for tunnel work, and were found to be highly satisfactory and efficient machines. These locomotives were of special benefit, because wet concrete was transported at high speed, eliminating the possibility of a trainload of concrete setting.

One of the most essential features in tunnel driving is efficient ventilation, which was obtained by operating blowers by electric motors. It was possible to ventilate the Elizabeth tunnel, so that the men could return to work within 20 minutes after the firing of a round, when the heading was being driven two miles in from the portal, and an 18-inch blower was set up outside of the tunnel.

Practical Limitations to Power-Factor Correction

Influence of Location of Corrective Apparatus Upon Generator and Conductor Capacity and Voltage Regulation—Proportioning of Kilovolt-amperes and Kilowatts—Summation of Individual Power-Factors

By LIEUTENANT RALPH KELLY

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AT FIRST glance, correcting the power-factor of a power network appears to be a simple undertaking. Yet when all the factors that enter into power-factor correction are considered, it is surprising how much detailed calculation and thought such an apparently simple problem demands. It is by no means unusual to discover after proper analysis that no material gain will be derived by the raising of the line power-factor, or that the desired results can be obtained by the addition of a synchronous motor or a rotary converter rather than a synchronous condenser.

To begin with, what gain is it possible to realize by raising the power-factor of a power system? When the power-factor of a power line is corrected by the addition of a synchronous condenser to that line, the reactive kilovolt-amperes of the line is reduced, the kilowatt load is approximately the same and the resultant of these two loads, the total load, is reduced. The current carried by the cables may be correspondingly reduced, which will either permit of an equivalent increased load on the system or a reduction of the present load to within safe heating limits provided that load is excessive.

This reduction is twofold on the generators, for in addition to the reduction in line or generator kilovolt-amperes, the power-factor of the generator is improved. In an alternating-current generator the field heating is less for a given kilovolt-ampere load with high power-factor than for the same kilovolt-amperes at a lower inductive power-factor. The generators on a power line that require correction in the majority of cases are limited in overload by the field heating so that there is a possibility of a gain in generator load due both to the reduction in total kilovolt-amperes as well as to the improvement in power-factor.

There is a possibility of steadying the voltage at the end of a long power line by the addition of a synchronous condenser. This is a special problem not directly connected with power-factor correction, however. It is of interest in that this effect may be obtained from a standard synchronous condenser applied for power-factor correction, and is one of the factors that should be considered in adding a synchronous condenser to a power line. Very often the location or the rating of a condenser may be changed, so that considerably better voltage regulation may be obtained coincident with the required power-factor correction. A standard synchronous condenser designed solely for power-factor correction is usually good for at least 50 per cent of its rating at zero per cent lagging power-factor, a rating that is often sufficient to maintain the voltage regulation within satisfactory limits on commercial lines at light load periods.

When a condenser is added to a system to alleviate cable heating, there is usually one correct location and several incorrect locations at which it may be placed. As a simple example of an incorrect position, consider a power line on which there is only a single factory load concentrated at the end of the line. If a synchronous condenser were placed in the generator station the power-factor of the generator would be improved, but the line conditions and consequently the cable heating would not be changed. On a more complex power line there is always the possibility of not obtaining the maximum benefit from a synchronous condenser by not locating it in the best position on the system. That position should be as close as possible to the inductive reactive kilovolt-amperes for which the condenser is to compensate.

A power line is often stated to have a certain definite power-factor without it being realized what an extremely indefinite and variable quantity that power-factor is. Fig. 1 shows a typical network of a small power system with three branches. At point (A) on branch A, the line power-factor is that of load (1); at point (B) the line power-factor is that of the combined load of (1) and (2); at point (C) that of loads (1), (2) and (3); at (D) the power-factor is that of the combined loads of 1, 2, 3, 4 and 5, which is the power-factor of branch A. The power-factor of the other branches varies similarly. The system power-factor at the generator station is the combined power-factor of branches A, B and C.

Again, the power-factor of each load usually varies

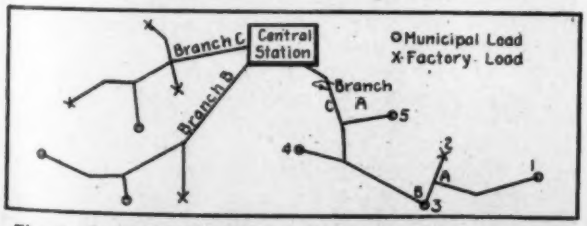


Fig. 1.—Schematic Diagram, Showing Location of Central Station, Circuits and Various Loads.

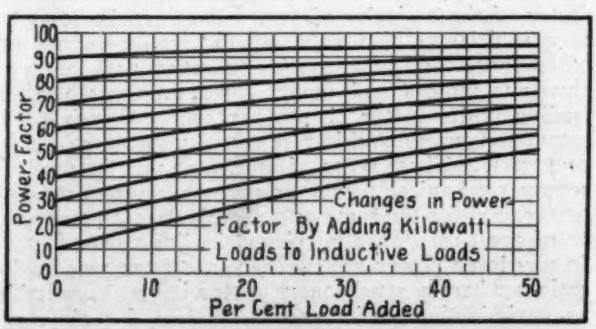


Fig. 2.—Chart for Determining Effect Upon Power-Factor of Adding Kilowatt Load.

with the number of machines in operation, the amount of load on those machines, the number of lamps burning, etc., which, of course, varies throughout the day. Thus the power-factor is different at different sections

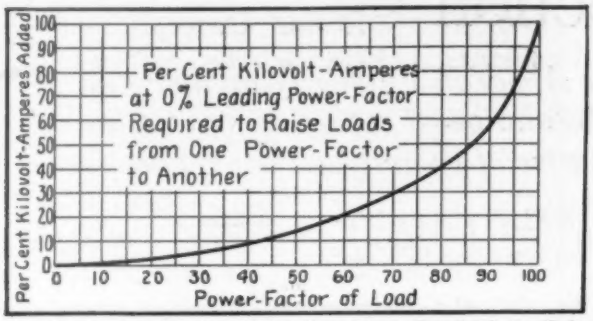


Fig. 3.—Curve Showing Kilovolt-amperes Required to Raise Power-Factor From One Power-Factor to Another.

of the line and at different hours of the day. The power-factor of the line as ordinarily stated is the power-factor at the generating station when the generators are carrying their heaviest load.

The problem of placing a condenser to best advantage in a power line network is not an easy problem. It is not always possible to locate it at the geographical mean of the reactive loads for which it is to correct on account of other line factors. The fact that is patent, however, is that the entire problem must be studied analytically from the standpoints of the different line power-factors, the change in these power-factors, the estimated future changes in line conditions and the available spots for locating a condenser. When all of these factors have been completely investigated, the rating and the position of the required condenser can be readily determined.

When the power-factor of an inductive line is raised by a synchronous condenser, the total kilovolt-amperes of the line is reduced, and as previously stated, the generator is thus able to take more load not only by the amount of reduction in line kilovolt-amperes but by an additional amount due to the improved power-factor. It is to be noted, however, that although the kilovolt-amperes of the line have been reduced, the kilowatt or energy load has remained the same except for the slight increase due to the condenser losses. The limitations of the source of energy supply for steam engine stations is the boiler and turbine capacity; for gas engine stations, the capacity of the engine, and for water wheel plants, the amount of water at all seasons of the year and the water wheel capacity. Thus, where a synchronous condenser is added to a power line so that more load may be obtained from the generators, the source of energy supply must always be taken into consideration.

If voltage regulation is not required, the power-factor of the majority of power lines can be brought to a sufficiently high value by the intelligent use of other forms of synchronous apparatus, such as synchronous motors and motor generating sets (either leading power-factor or 100 per cent power-factor), rotary converters, and in rare cases synchronous phase converters. These types of apparatus may be used to supply mechanical power or necessary direct-current power, and for the same or a slightly greater cost may be of great assistance in raising the line power-factor. In any large power system there are numerous applications where a synchronous motor is just as suitable as an induction motor such as motors for air compressors, ammonia compressors, ventilating fans, centrifugal or plunger pumps, motor-generator sets, and many other less general applications.

The central station cannot control these applications as directly as a factory that supplies its own power, but it can control them indirectly and very effectively by penalizing customers that take a load at a power-factor less than a reasonably high value set by the power company. The line power-factor may also be improved by correctly locating and determining the manner by which alternating-current power is converted into necessary direct-current power. Very often rotary converters at 100 per cent power-factor are sufficient for this duty, but if more correction is required it is but a simple matter to convert the power by means of a motor-generator set operating at 80 or even in extreme cases at 70 per cent leading power-factor. For the rare cases where a phase converter is installed it should be understood that a synchronous phase converter is just as suitable for phase conversion as an induction phase converter and has the advantage that it can be designed for leading power-factor operation with but a comparatively slight increase in cost.

The extent to which loads at unity power-factor will correct systems of low power-factor is not generally realized. A quantitative idea of the numerical value of the power-factor to which unity power-factor loads will correct single resultant loads at different power-factors is shown in Fig. 2. The ordinates of these curves represent power-factor and the abscissas represent kilovolt-ampere loads at 100 per cent power-factor in per cent of the original kilovolt-ampere load. For example, consider that an original line carrying 1000-kva. at 60 per cent power-factor is selected and a 300-kw. load is added to that line. The resulting power-factor from the curve is 74.6 per cent. If 500 kw. at 100 per cent power-factor were added to the original line, the new power-factor would be 81 per cent, an increase in power-factor of 21 per cent.

By combining the corrective effect into a number of smaller units, not only is the cost of a large condenser saved with a consequent saving in floor space, switching apparatus, etc., but the corrective effect is more effective in that it is scattered over the line and placed much closer to the reactive kilovolt-amperes that it is to correct, than would be possible with one large condenser.

In power-factor correction it sometimes occurs in practice that power companies swing to the opposite extreme and correct the power-factor of their system to a greater value than is economical. Besides the limitations previously discussed there is danger of correcting the line power-factor beyond the point of economy after which the gain in line power-factor is not at all commensurate with the additional cost for that power-factor increase. This is very clearly illustrated in Fig. 3 and gives the per cent kilovolt-ampere load at zero power-factor leading to correct 100 per cent kilovolt-ampere load from one power-factor to another. From Fig. 3 it can be seen that whereas it only requires one-half of 1 per cent to correct 100 per cent load from zero to 10 per cent power-factor, to correct the same load at 90 per cent inductive power-factor to unity power-factor requires a condenser of 43.4 per cent of the original line capacity. Obviously it is not practical to add additional power-factor correcting equipment to raise a line power-factor over 90 per cent. This statement does not apply where necessary motive apparatus is to be added to a power line and a 100 per cent power-factor synchronous motor or rotary converter may be applied without additional cost for the application.

Electricity in Coal-Mining Operations

Mine Haulage by Electric Locomotives — Electric Rotary Drills — Electric Blasting — Advantages of Electric Service

By FRANK HUSKINSON

Chief Electrician, Rocky Mountain Fuel Company

This is the third of a series of articles dealing with electric power applied to the numerous phases of coal-mining operations, including surface and underground haulage, drilling, undercutting, pumping, signaling and coal handling. The series also gives interesting facts relative to changing from the isolated power plant to central-station service. The questions of mine lighting and telephone systems and electric blasting are also given attention.

THERE are three types of electric locomotives now in general use in coal mines. The standard, and most practical, and one that is in use successfully, is the electric traction locomotive; the rack rail drive, and a combination of both the friction and rack drive. The first can be used on a good track up to a five-percent grade. The rack rail is used for the greater pitches that are met with in some mines. The combination finds its place where the track is both ordinary and steep, such conditions being found in some hilly mines. The rack rail type is not a very popular locomotive, because of the care necessary to maintain a good roadbed and in keeping it clean; also much work is required to keep the rack rail in good shape. In the case of a live rack rail it is very important to keep the rack rail well insulated and protected.

By another classification, the electric traction locomotive may be divided into the standard, gathering and crab types. The locomotive of the standard type has a drawbar at each end and travels along mine entryways, using a trolley line and bonded rails as mediums through which power is transmitted.

The gathering locomotive is of the standard type, but having, in addition to the regular trolley pole, a reel of duplex insulated cable, and an auxiliary motor. This reel of cable is connected up to the auxiliary motor by which it may be reeled or unreeled. One end of the cable is attached to the trolley wire, while the other end is attached to the rail. With these connections the locomotive may move along into rooms and mine chambers to gather up the cars of coal. The length of the reel of cable ranges from 250 to 500 feet.

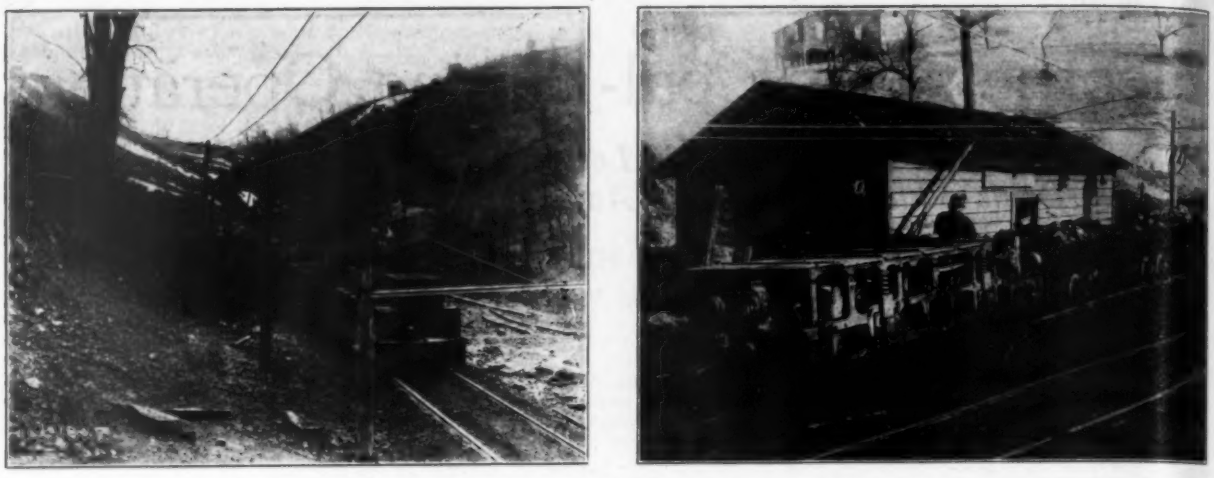
The crab locomotive is equipped with an auxiliary motor-driven drum, carrying a small haulage rope which is paid out by the motorman as the car-runner pulls it into a room or entry and attaches it to a loaded car of coal. The locomotive then draws the car out of the room, this operation being repeated until several cars are pulled out of the rooms, when they are hauled to the main partings where they are picked up by the larger-sized standard locomotives which haul out to the tipple 20 to 60 cars at a trip. At the tipple the mine cars of coal are dumped into the railroad cars for transportation to markets.

The standard electric traction locomotive is equipped with one to three motors, which are hung in the frames and so mounted upon the driving axles as to allow a vertical movement so as to make differences in gear-meshing impossible. Spring supports are employed to reduce vibration and lessen the strain. The size, weight, speed and voltage of mine locomotive motors are determined by local conditions.

This type of locomotive is controlled by a series-parallel controller, the resistances being generally of the cast-grid type, although the pancake type of flat-iron ribbon-wound is used on some types of mine locomotives.

The up-hill haulage in mines, with grades as much as 15 per cent, are handled to advantage by the rack-rail system. The requirements for positive haulage may be fulfilled by the rope haul; but the locomotive furnishes a much more flexible system of operating

Slabbing and Loading Machines in Coal Mines.



Electric Coal-Mining Locomotives Operating on the Surface.

and is more convenient. With a rack-rail system of haulage the main parts are a strong and durable rack rail, supported by the track ties; and in case of the use of a live rack rail it will also have to be well insulated away from the earth and the rails. The rack-rail locomotive has a powerful motor that drives sprocket wheels which engage in the rack rail to produce the forward motion. There are two styles of racks used—the live rack and the dead rack. The live rack serves not only as a haulage rack, but also as a conductor for the power current, eliminating the use of the trolley-pole and the overhead wire. The rack rail is well insulated and covered in its method of support, insuring against injury to men or animals by contact therewith. The dead rack serves only as a haulage medium for the driving sprockets of the locomotive to work against in positive pulling. In this case the trolley-pole and overhead wire are used. In the combintion rack-rail locomotive the wheels are keyed and connected up with the motors so that the locomotive will also run on the plain track the same as the standard type. In the straight-rack locomotive the tractive power is all in the sprockets that engage in the rack rail, making this type suited for use on the rack rail only.

There are a few cases of double-trolley wire installation at some of the mines which give the locomotive a metallic return and the rails do not have to be bonded. The writer has just put in a combination system of two trolley wires and the rail at the Delagua, Colo., mines. This is something new in the way of a haulage system. It has some very interesting points, due in a large part to the local conditions, which will be explained fully at a later date.

In all electric mine-haulage locomotives, the motors are series-wound, and on the later types inter-poles are used. In reference to electric haulage locomotives, there has been some remarkable improvements in the electrical quipment as well as in the mechanical design within the last 15 years. The alternating-current locomotive probably will be the one most in use in the next years, but up to date it is not used to any great extent. The storage-battery locomotive is becoming more popular and there are quite a number of them in use at the coal mines. A combination storage-battery and trolley type of gathering locomotive is also used at the coal mines. The ability of the storage-battery gathering locomotive to run any place where track is laid, regardless of trolley wires, or bonding of rails, and without being restricted by the length of cable, has its advan-

New Articulated Type of Storage-Battery Mining Locomotive. Battery Box Is Supported Between the Two Trucks. This Construction Is Especially Suitable for Low Headroom.

tages in the coal mines. The armature of this type of a motor has two windings on it and two commutators. When the locomotive is operated from the trolley wire, power is taken through one of the armature windings to drive the motor, and the other armature winding acts as a generator, generating power for charging the batteries. When the locomotive is operated from the battery, that portion of the armature winding, which previously acted as a generator for the charging of the battery, is now used for the driving of the motor. This is a type that is just coming into general use at the coal mines.

Electric Rotary Drills.

In the modern coal mine the holes, in which to place charges of explosives for blasting down the coal, are drilled both quickly and economically by the use of the portable electric rotary drill, which is a powerful, serviceable and efficient machine for coal drilling.

In all coal mines there is a quantity of roof rock and other materials that have to be removed, first by drilling holes and then by blasting it down. The electric rotary drill is a machine that handles this class of work to perfection.

Electrically Operated Coal-Loading Machine That Saves Much Labor.

This drilling unit is a portable outfit and is very easily moved about in the mine on a small truck. The power required for the motor, that operates the rotary drill, is taken from the same lines that supply power to the mining machines, by means of a small duplex cable which is carried with the outfit on a small reel. The motor used for the rotary drill is a series-wound machine, usually of three horsepower. The drill feed is reduced by a set of double gears. All gears are interchangeable with others of different sizes, so that almost any kind of a combination for revolutions of auger and rate of feed can be obtained by changing the gears. This makes the rotary drill adapted to several classes of work and makes it a very flexible drilling outfit, suitable for drilling in all grades of coal, slate and rock.

Electric Blasting.

Blasting in coal mines by electricity, whereby it is possible to fire a number of charges simultaneously, is not only the most effective and economical, but it contributes more to safety than does any other method.

An electric blasting cap consists of a special form of detonator which is fired or exploded by an electric current. The explosion of the cap, of course, is followed by the firing of the blasting charge. The blasting machine, used to generate the current for firing blasts, comprises a small, portable dynamo, the armature in which is rotated by the downward thrust of a rack-bar. Another method of electric firing of blasts in coal mines is by the use of a low-tension fuse or cap which is detonated by three or four dry cells.

Electric Standard Mining Locomotive.

In mines where there is a large amount of blasting to be done, and in which a considerable number of holes are connected up in series, to be shot off at the same time, the method of using current from the lines from which mining machine motors are driven has been successfully carried out. However, the use of the portable dynamo, taking it all around, is considered the safest and most satisfactory.

Electric blasting in gaseous coal mines, or in those in which the atmosphere holds fine coal dust in suspension, is the only method which should be considered, as by it the danger of gas explosions is reduced to the minimum.

Almost every kind of blasting that can be done by the cap and fuse method can be done more safely and more quickly by the use of electricity, and delayed explosions are hardly possible.

CLASS FOR RADIO OPERATORS AT STEVENS INSTITUTE.

The Stevens Institute of Technology, Hoboken, N. J., has inaugurated new free evening classes for the training of drafted men as radio operators. The course provides for instruction in sending and receiving messages with desired proficiency at twenty words per minute. The classes are held every evening from Monday to Thursday, inclusive, from 7:30 to 9:30 o'clock.

Electrically Operated Slabbing Machine in Coal Mine.

ADDITIONAL POWER FOR LINE SHAFT THROUGH TURBINE DRIVE.

Low-Pressure Steam Turbine Meets Power Need Through Speed-Reduction Gear Drive of Line Shaft.

Electric motor drive, the simplest solution to additional power supply problems, is often not available to mill owners whose plants are driven by line shafts. Occasionally, however, there is sufficient boiler capacity in the plant to do the work, if it is effectively applied. Particularly where line-shaft drive to a small number of machines is used, the installation of a turbine with speed-reducing gears is an ingenious solution to the problem.

A unique line-shaft drive, consisting of a Westinghouse low-pressure turbine and a Westinghouse double reduction gear has been installed in a western Pennsylvania paper mill. There are two main line shafts to which the machines are belted. To one shaft are belted two cutters, ten beaters and one Jordan; an identical equipment, with the exception of the cutters, is belted to the other shaft. Only seven of the ten beaters, under ordinary running condition, are in operation at one time and these, with one Jordan, require about 600 horsepower. An additional 20 horsepower is used for the rag-cutters.

Heretofore, these two shafts were each driven by a non-condensing reciprocating engine. However, one of these engines was wrecked and so necessitated the obtaining of a drive to replace it at the least ultimate expense.

It is interesting to note the considerations entering into the final selection of the new drive. These conditions were somewhat as follows: Two 100-horsepower non-condensing engines turned the rolls and gave practically all the exhaust steam necessary for feed-water heating, so that all the exhaust steam from the 700-horsepower non-condensing Corliss engine driving one of the line shafts would have to be discharged to the atmosphere, unless some means were provided for abstracting the energy still available in it. A low-pressure turbine was the logical prime mover, without a doubt, but it would have been of little use, on account of its high speed, had there not been a reduction gear to receive the power generated and to deliver it to the line shaft at low speed.

A few approximate figures show more clearly the fitness of the low-pressure turbine for this application. The exhaust steam from the 700-horsepower Corliss engine was more than sufficient to give 600 horsepower in the low-pressure turbine. The engine takes steam at 150 pounds pressure and exhausts into an oil separator at a back pressure, depending on the load, from 0 to 4 or 6 pounds, which is approximately the pressure of admission to the low-pressure turbine. The steam is then expanded in the turbine down to a vacuum corresponding to 27½ inches of mercury referred to a 30-inch barometer, the vacuum being maintained by a Westinghouse-LeBlanc low-level jet condenser and air pump. The pumps are centrifugal and are driven by a small turbine through a reduction gear. They take their water from a nearby creek and discharge it from the condenser into a reservoir at an elevation of 45 feet, the water being then used in the manufacturing processes. The small turbine runs non-condensing, and its exhaust steam goes to the feed-water heater, so that only a part of the heat energy in the steam used by it can be charged to the turbine, and even that cannot be charged against the main turbine, for it is used to do work in elevating the discharge water from the condenser to the reservoir and should be charged against the total cost of manufacturing. In brief, it may be said that this paper company actually gets 600 horsepower without paying a cent for steam, and that it is using just one-half the steam it formerly used with two reciprocating engines to obtain the same power.

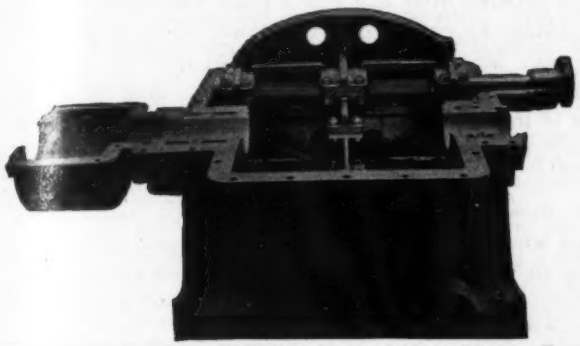
While this particular mill was not enlarged, it is evident that with a given amount of exhaust steam, either from non-condensing engines or condensing engines run non-condensing, a large increase of power is made available by the installation of a low-pressure turbine. Further evidence of this possibility for expansion is the fact that in this paper mill when the two line shafts were driven by non-condensing reciprocating engines, a battery of 13 boilers was required,

View of Turbine at the Left and Two Reduction Gears at the Right.

whereas, now only 8 boilers are required for the maximum load.

The Reduction Gear.

So far this has been a discussion of the application of a low-pressure turbine, but the means of transmitting its high-speed power to a slow-speed line shaft is fully as interesting and important. The change in speed is made by means of two reduction gears because the first cost of a single gear and pinion of ratio 36 to 1 would be prohibitive, and the gear would be very large and unwieldy. The first speed reduction, 3600 r.p.m., to 720 r.p.m. is made with a fixed-bearing type of reduction gear, the gear shaft of which is



Three Pinion Bearings Supported by a Frame Which in Turn Is Carried on Two Supports of I Section.

direct-connected to the pinion shaft of the second gear, which reduces the speed from 720 to 103 r.p.m.

This larger reduction gear is of the flexible-pinion-frame type, better known as the Westinghouse I-beam type. It is this I-beam feature which makes the application of the geared drive possible.

In this, the pinion is supported on three bearings in a frame, as shown in an accompanying view. This frame is supported under the middle bearing on an I-beam at right angles to the pinion axle. The flexibility of the web of this I-beam support allows the pinion to tip slightly and to let the teeth of the pinion line up with those of the gear. This lining-up is entirely automatic and instantaneous in operation, so that no mechanical complications are encountered and no adjustments from the outside of the gear case are necessary at any time.

Both reduction gears are lubricated by sprays of oil directed upon the teeth just before they mesh. The pressure is maintained by a pump geared to the gear shaft. This pump also supplies oil under pressure to all the bearings in the two reduction gears. For starting, a hand pump is provided which insures a plentiful supply of oil on the bearings and teeth.

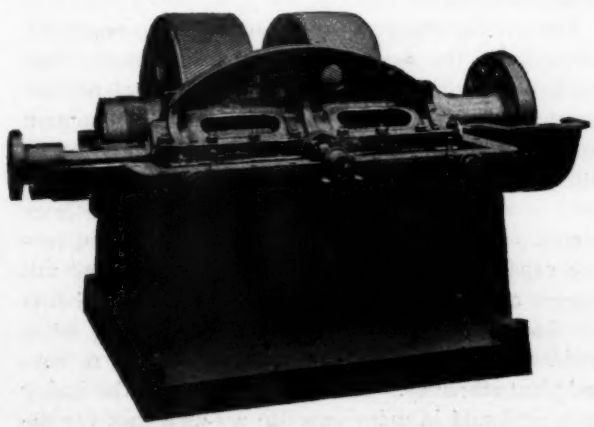
It may be asked why a fixed-bearing type of reduction gear was used in one case and an I-beam in the other. It was a question of tooth pressure which determined the design. Take, for instance, a pinion transmitting 600 horsepower at 3600 r.p.m., which was the case of the first reduction gear in the particular installation under discussion. If the same pinion were to turn at 720 r.p.m. and with the same tooth pressure (i. e. pounds pressure per inch) of tooth face it would be capable of transmitting one-fifth of 600 horsepower, or 120 horsepower only. It follows, then, that the second gear would have been made five times as large as the first if the same type had been used, and for the transmission of the same amount of power such reduction gear would have been large and bulky. It would also have been costly, because cost is a function of size.

In order to make a reduction gear which would be within reasonable limits as to size and at the same time marketable, the allowable tooth pressure had to be increased or, in other words, the factor of safety included in the allowable stress in ordering fixed bearing design had to be lowered. But if this were done, some other safety factor would have to be incorporated to insure reliability of operation, otherwise a slight misalinement of the teeth and uneven distribution of tooth pressure would have resulted in a failure of the gear.

This safety factor was found in the Westinghouse I-beam support for the pinion which corrects any misalinement and uneven pressure distribution which might otherwise exist. Misalinement might have been due to temperature changes, slight but unavoidable inaccuracies in workmanship, or distortion of the bearing supports in the housing, due to varying loads or changes in foundations and, if not corrected, would have caused the total tooth pressure to be concentrated at one part of the tooth, which would have overstressed that part of the tooth.

In the case of the reduction gear with fixed bearing support for the pinion, misalinement, although practically prevented by good workmanship, will not have disastrous results if it should exist, because of the high factor of safety used in the tooth design. In other words, localization of total tooth pressure would not stress the metal beyond a safe limit.

The self-alining feature, the forced lubrication, the rugged construction of the parts, and the workmanship on these reduction gears make them a very efficient and reliable means of transmitting power. The actual efficiency of the two gears together is 97 per cent, showing that only 3 per cent of the total power transmitted is lost in them. This energy is dissipated in the form of heat and is taken up by the oil, which in turn is cooled by a water cooling system. As to reliability, in the paper mill under discussion, the double reduction gear has run 24 hours per day, six days per week, under maximum load, and it has never been shut down on account of trouble with the gears.



Flexible-Frame Gear With Cover Removed.

RATE INCREASES IN NEW ENGLAND.

The Claremont Power Company has recently been granted by the Public Service Commission of New Hampshire an increase of one mill per kilowatt—this increase to affect only the large power consumers. This same increase has been granted the Colonial Power & Light Company by the Public Service Commission of Vermont.

Editorial Comment

Coal Competence and Consequence

COAL production is not being maintained at the rate expected, and the rate is, in fact, decreasing as the need for increase becomes more and more imperative. As winter approaches, coal production decreases, while excuses and explanations multiply. Unfortunately, explanations will not heat homes nor furnish the wherewithal to keep industry going, nor give central stations the energy with which to keep lights burning, motors turning and street cars moving. It is coal, not excuses, that the country wants. And it is coal, not explanations, that will be demanded when cold weather comes.

Conditions in and at the mines have, in the average, greatly improved. The railroads appear to be the cause of the hitch in getting coal from mine to consumer. It seems to be impossible to co-ordinate cars available with mine production. Where there is the mine output there cars are unobtainable. Where the cars are, coal is lacking. Co-operation and co-ordination are absent. Meanwhile we are told to store coal but cannot get it. The summer is passing, as the demand for coal assumes greater proportions, while production decreases.

Considering the coal situation from the restricted viewpoint of the central station has its lesson. The experience of the majority of steam-making plants last year was bad enough as regards inability to obtain coal. But when coal arrived it was frequently mixed with unprecedently and inexcusably large amounts of dirt. It was bad enough to pay for dirt at the price of coal. But this was not all. The dirt reduced furnace capacity, plant output was lowered, choked ash hoppers and crippled ash-handling apparatus still further handicapped plant operation and caused labor troubles, while dirtier flues added their quota to lowered plant efficiency. To make things worse, the fusing dirt was found in many cases to act as a flux for the firebrick, causing failures and additional expense. But even these did not suffice. No longer would a boiler room become accustomed to the use of one fuel than it changed, and capacity and efficiency suffered until the boiler-room force accustomed themselves to the change, when the quality would probably change again. It was partly to remedy this, although to eliminate the waste of cars for hauling incombustible was the predominating reason, that the Government issued its clean coal order, admirable in the spirit but difficult to enforce in practice.

All these things—the shortage of coal, the erratic delivery, the variation in quality and the soaring prices—have emphasized unmistakably the immense value of the central station possessing a financial interest, directly or indirectly, in one or more coal mines, preferably situated in different localities on different railroads, so as to reduce susceptibility to railroad, mine and labor troubles.

The power house at the mine, at present more a slogan than a fact unfortunately, brings with it a close bond between mine and power plant which might with advantage be extended to the power plant farther removed. Many companies have had interests in coal mines for several years, to their profit. And the number is increasing at a pleasing rate. The practice is based upon sound business. Many of the central-station troubles last year would have been obviated had those same utilities controlled their coal supply. And what happened last year may happen again this. It is well for the central station to control its own coal supply, on the score of cost, continuity of supply and maintenance of quality.

France and Her Water Powers

AT THE recent Civil Engineers' Congress in Paris, Commandant H. Cahen discussed the important role played by water-power in war time. Before the war, France utilized 750,000 horsepower of water power, being only 10 per cent of her total of 8,000,000 horsepower available water power. In August of 1915, after one year of war within her midst, France, at the request of the Under-secretary for War Materials, made a start to intensify her water-power resources. Since the end of 1915 the water power that had been or was in course of development represented not less than 565,000 horsepower, and that actually harnessed reached 850,000 horsepower. At the end of 1917, after three years of war, 120,000 horsepower was placed at the disposal of the national defense. In 1918 330,000 horsepower will be harnessed, and by the end of 1921 France will have at least 1,600,000 horsepower from waterfalls under control.

In spite of many difficulties, unconquerable France has turned her water power to good use. Much of the newly developed water power has been absorbed for electrochemical and electrometallurgical purposes and long-distance transmission. Some of it has been used directly by utilizing the static pressure of the water of high falls for operating presses in the manufacture of rough shell forgings, thus saving labor and fuel and time.

From first to last unity has reigned between the utilities, manufacturers and authorities. In many cases authorization has been given to develop and utilize water power without waiting for formalities, because the country was at war and haste was imperative. It was for France that her water powers were

needed, and it was for France that the water powers have been put to use.

What an example France offers us as regards our water-power development, as in so many other things. France, whom we admire so much for her valor, her art, her democracy, and her thrift, has put us to shame. Without war in our land; without Boloism and defeatism rife amongst us; with all our resources at our own disposal; with all the enormous benefits that came to us in the way of prosperity and war profits without their just price, we have done less than France, bled white by the ravages of war as the Huns wage it, in the way of developing our water powers. We slept and did nothing while France fought for freedom and democracy, yet finding time to develop the natural resource with which she had been blessed, and that has since proved a blessing indeed. We wrangled and squabbled and frittered time away while France acted and fought battles that were our battles.

One of the past strongholds in hydroelectric development, America has lagged behind while our unconquerable ally, torn with war in her land, with her industries strangled and her very existence threatened, has soared ahead, putting us to shame. But what is the use of meditating and regretting while our water powers with their vast potential energy of enormous intrinsic worth continue to flow to waste? Are we to ever stand by passive, bemoaning inability to obtain coal, criticizing our railroads for failure to haul it, while we use coal where we could use water? We would be like a spoiled child, leaving untouched that within its reach while striving for that beyond, were our failure to develop our water powers not so criminally wasteful, pitifully foolish. Wake up, America, and retrieve the time that has been lost.

Efficiency Engineering and the Recording Electrical Meter

ALMOST anyone, capable and conversant with and understanding thoroughly a process or undertaking, becomes an efficiency engineer when visiting some other plant than his own. He sees what those long familiar with their surroundings, apparatus and mode of working have from custom and familiarity failed to notice. Things impress him that fail to impress those conversant with them. This is perhaps the major secret of successful efficiency engineering, it being taken for granted the efficiency engineer is expert in his calling.

Improvement in plant performance, increased production and lower production costs, improved quality, saving of fuel, labor, time and materials, better power-factor and higher load-factors and conservation of capacity—these are some of the things that the war has forced to the fore, and things that will remain to the fore when the war is won. These are things, to be sure, that the efficiency engineer can usually bring about with varying degree of success, depending upon what room there was for improvement and the extent to which he is supported by the management, and so forth.

However, considerable plant improvement can often, in fact can usually, be brought about without the efficiency engineer. All plants cannot afford the employment of the efficiency engineer. Many would find little justification in employing one. But no plant can afford to go on without knowing what is being done, how it is being done, or not bettering performance where feasible. To bring about improvement is very largely the sphere of the electrical recording instrument.

The electrical recording instrument—voltmeter, ammeter, wattmeter, power-factor meter, wattless-component meter, maximum-demand meter—may one or all be the efficiency engineer, so far as anything inhuman can be. By its use, and one may be used throughout a plant with surprising diversity of purpose, conditions in the circuit of supply, the loading and functioning of machines, the effort of labor and the variation of processes can be brought to light. Men laying down on the job, employes late in starting and quitting early, excessive friction losses, needless idle running of machines and countershafts, plants working slowly instead of at maximum speed, changes in performance from day to day and even hour to hour, overloads and shortage of capacity, low voltage and its effect upon machine performance and plant production, low power-factors and excessive peaks due to simultaneous operation of machines, are some of the things the electrical recording meter will show, if studied with a little intelligence.

The recording electrical instrument is as useful in the electrically operated industrial plant as in the power house or substation of the utility. In the hands of the wide-awake superintendent or electrician alert to its possibilities, the recording meter stands for better results at less expense. It enables savings. Electrical surveys pay, whether made by the industrial plant or made by the utility and paid for by the industrial plant, which, by the way, is one way in which the smaller industrial concerns may obtain what they otherwise might not be able to. Incidentally, lighting surveys are also a paying proposition at this time. Central stations are more interested in keeping down the peak, keeping up the power-factor and improving the load-factor than in acting as efficiency engineers for their customers. Nevertheless, as such they can usually accomplish good, earning the gratitude of their clients and improving their load.

The electrical recording instrument deserves far greater and wider use than it is receiving by utility and industrial plant alike. To the efficiency engineer it is indispensable; to the plant without an efficiency engineer it is invaluable as being the next best thing to an efficiency engineer. One wonders if the electrical recording instrument is being allowed to do its best, in these war times, in speeding production and accomplishing all possible economies. We doubt it seriously.

Week's Events

A. E. F. Section of A. I. E. E. Organized—Outlet Campaign Plans—Activities of National Engineering Societies

A. E. F. SECTION OF A. I. E. E.

Section Organized By Institute Members in France.

Early in May a cablegram was received at Institute headquarters from Capt. E. H. Martindale, Engineer R. C., a member of the board of directors of the Institute, now serving with the American Expeditionary Forces in France, requesting authority to organize a section of the A. I. E. E. among the American Expeditionary Forces, the formal application and petition required under the constitution to follow by mail.

The matter was considered by the board of directors on May 17, and the sentiment of the board was unanimously in favor of granting the desired authority, but it was felt that in the absence of specific information it would be necessary to defer formal action until the receipt of Capt. Martindale's letter and the petition, and the secretary was directed to cable Capt. Martindale accordingly. The formal approval of the board was subsequently granted at its meeting held in Atlantic City on June 26, 1918, the papers having been received in the meantime and the petition being in proper form and complying with the constitutional requirements. The new section is to be known as the A. E. F. Section of the American Institute of Electrical Engineers.

A large number of Institute members are now in France and in his letter Capt. Martindale stated that there were some three or four hundred engineers stationed in the immediate vicinity where it was proposed to establish the headquarters of the section, and that there was a general feeling among these engineers that there should be a local organization of the A. I. E. E. through which certain professional activities such as carried on by the Institute sections in the United States might be continued.

In granting the petition there was a general understanding that the provisions which apply to sections in the United States, with reference to territory and financial support, cannot be strictly applied to the A. E. F. Section ,but that these are details which must be dealt with as the section may develop. The petition was signed by the following members of the Institute, who will form the nucleus of the A. E. F. Section:

Bert L. Baldwin, Major, Engr. R. C.; Landon R. Berkeley, 1st Lt., Engr. R. C.; A. M. Bohnert, 1st Lt., Engr. R. C.; E. C. Brantley, 1st Lt., Engr. R. C.; C. DeF. Chandler, Colonel, A. S. S. C.; C. E. Chatfield, 1st Lt., Engr. R. C.; Frank J. Clarke, 1st Lt., S. R. C.; Frank H. Fay, 1st Lt., S. C.; John H. Finney, Major, Engr. R. C.; W. N. Gambrill, 2nd Lt., Engr. R. C.; A. H. Griswold, Major, S. R. C.; Emil Hohn, 1st Lt., Engr. R. C.; Edwin K. Hollinger, 1st Lt.; S. R. C.; Sidney D. Kutner, 2nd Lt., Engr. R. C.; T. L. B. Lyster, Major, A. S. S. C.; E. H. Martindale, Capt., Engr. R. C.; Frank C. Merriell, Capt., F. A. R. C.; Harry A. Mills, 1st Lt., S. R. C.; R. B. Owens, Major, S. R. C.; A. E. Pierce, Major, Engr. N. A.; Samuel Reber, Colonel, S. C.; Edgar Russell. Brid. Gen., N. A.; George E. Shepherd, Capt., Engr. R. C.; H. E. Shreeve, Major, S. R. C.; R. W. Stovel, Major, Engr., R. C.; F. P. Townsley, Capt., Engr. R. C.; H. E. C. Winshurst, 2nd Lt., Engr. R. C.; H. C. Wolf, 1st Lt., Engr. R. C.

Members of the Institute and other engineers who may be interested in the A. E. F. Section are requested to communicate with Capt. E. H. Martindale, Engineer R. C., c/o D. C. & F., A. P. O. 717, A. E. F. France.

RAILWAY ELECTRIFICATION MAKES PROGRESS IN THE NORTHWEST.

Hydroelectric Plants at Spokane to Be Increased—Pole Lines and Substations Built By C., M. & St. Paul—Probable Co-ordination of Power Systems.

Washington Water Power Company, Spokane, Wash., which has two hydroelectric generating units, each 22,000 horsepower, at its Long Lake plant, has purchased the equipment for another unit of similar capacity to be installed in the same plant next year. The equipment ordered consists of an I. P. Morris & Company water wheel, a General Electric generator, and a 19,000-kva. bank of transformers, also being supplied by the General Electric Company. This increase in facilities for power production is to meet the requirements of the Chicago, Milwaukee & St. Paul Railway Company for the portion of its line now being electrified between Othello and Tacoma, Washington, a distance of nearly 300 miles. In the supply of power for this line there will be co-ordination between the Washington Water Power Company, on the east, and the Puget Sound Traction, Light & Power Company on the west. The two power companies will deliver electricity to the Intermountain Power Company, a transmission concern, which is a subsidiary of the Montana Power Company, and which will serve the C., M. & St. P. Railroad.

The poles for carrying the trolley line from Othello to Seattle and Tacoma are all set, and are ready for the wires; and the substantial brick substation buildings, about 30 miles apart along the route, are practically completed. As previously noted, the copper wire for the line is being manufactured at Great Falls, Montana, by the Anaconda Copper Company. It is possible that this electrification will be completed early in 1919, and that by July 1, electric locomotives will replace those of steam power. The first train to be pulled over the Cascade Mountains, as will then be accomplished, will mark an epoch in Western Washington railroad operating. It will be a counterpart to the crossing of the Continental Divide by the same company's electrified line between Harlowtown, Mont., and Avery, Idaho.

Eventually and perhaps in the quite near future, the C., M. & St. Paul will also electrify the section between Avery, Idaho, and Othello, Wash., a stretch of

about 300 miles, which tranverses a territory already within reach of electric energy produced by water power. This accomplished would give the Milwaukee a continuous electric line of 1000 miles from Harlowton, Mont., to Seattle and Tacoma, for the operation of which all energy could be derived from hydroelectric plants. The completion and operation of that system, as may be readily foreseen, will bring about the advantageous co-ordination of three great power-producing concerns which utilize the mountain streams in generating electricity. These comprise the Montana Power Company, Washington Water Power Company, and Puget Sound Traction, Light & Power Company. When this is accomplished, as it surely will be, the result will be the greatest interconnected hydro-electric system on the continent. It means the conservation of fuel of the most logical and effective kind.

PLANS FOR SOCIETY'S OUTLET CAMPAIGN COMPLETED.

Helpful Sales and Advertising Matter Ready for Distribution to Participants.

The Society for Electrical Development as announced in previous issues, is inaugurating a "Save-By-Wire" Campaign, which commences with the beginning of September. Practically everyone knows that the use of household electrical appliances promotes the saving of war-time essentials—fuel, food, time, money, labor. And those within the industry well know that housewives invested over twenty-one million dollars in such appliances last year.

However, only those who have carefully studied the question realize that the continued enthusiastic use of such appliances by housewives hinges almost entirely upon there being available about the house an adequate number of convenient service outlets. As is pithily remarked in the Society's preliminary broadside announcement, "Women soon grow tired of climbing onto chairs and putting appliance plugs into lamp sockets."

That's the condition which the Society unearthed while seeking a basis for a campaign that would assist the electrical industry to keep business intact. The problem was:

(1) To assist central stations to fill the valleys of their day loads without increasing their "peaks" or occasioning need for new plant equipment and line extensions.

(2) To provide contractors with a plan that would enable them to get business without the result of embarrassing central stations by increasing their "peak" loads.

(3) To assist dealers by stimulating the market for appliances.

(4) To select such measures for the benefit of the foregoing as would also redound to the benefit of the manufacturer and jobber.

(5) To further the work begun by the Society a long time ago to educate the architect to the advisability of specifying plenty of convenience service outlets, separate circuits for appliances, and also to specify the use of ample copper in residence circuits.

(6) To provide that whatever the plan adopted it should be in full accord with war-time necessities and patriotic aims.

The keynote of the campaign is the attractive poster, which is by Vincent Aderente, the famous poster artist, and won the $500 public choice prize in the Society for Electrical Development Poster Contest, which was an affair of nation-wide interest a year or two ago. The "Save-By-Wire" message is of course a recent addition. The posters are on sheets 28 by 36 inch and are printed in six colors in an unusually attractive manner; their attention-compelling power is assured by their high artistic qualities.

With characteristic thoroughness, the society has provided for use of co-operators in the campaign a carefully planned and very complete equipment of advertising and selling helps. There are suggestions and materials for two window displays, copy and cuts in abundance for newspaper ads, movie films, mailing pieces, price tags for use in connection with sale of appliances, street-car cards, and so on. Also there has been provided a combination proposal and estimate blank which should prove an acceptable addition indeed to the business-getting equipment of the contractor.

ELECTRICAL COMPANY LICENSED TO USE ENEMY-OWNED PATENTS.

Splitdorf Electrical Company Authorized to Use Robert Bosch Patents on Magnetos.

The Federal Trade Commission announces it has licensed the Splitdorf Electric Company, of Newark, N. J., to use in the manufacture of magnetos certain patents hitherto exclusively used in this country by the Bosch Magneto Company, but found by the Commission to have been owned or controlled entirely by Robert Bosch, of Stuttgart, Germany.

The Bosch company, an American corporation, in opposing the grant of licenses to the Splitdorf company, presented evidence to show that Robert Bosch in 1913 had agreed to sell the patents to the Bosch Magneto Company for $275,000. From the evidence submitted, however, it appeared that the legal title is still held by Robert Bosch, and the patents stand in his name in the United States Patent Office.

The Commission therefore held the patents are enemy-owned or controlled, and as such subject to licensing to American firms.

The Splitdorf company is manufacturing magnetos for army airplanes and was directed by the War Department to embody the Bosch devices.

INDIANA LIGHT ASSOCIATION HOLDS ANNUAL MEETING.

The annual meeting of the Indiana Electric Light Association was held at the Claypool Hotel in Indianapolis. J. P. Ohmer, Elkhart, Ind., presided. In his opening address, he spoke of the difficulties under which the electric light companies, as well as other utility companies, were working. Governor James P. Goodrich welcomed the delegates. He said that he realized the extreme difficulties which confronted the utilities in war times but added that he felt sure the Indiana Public Service Commission would do all in its power to aid them. Governor Goodrich encouraged the utilities to do all in their power to make the best of great difficulties until the close of the war. Alexander Holliday, of the Indiana Public Service Commission, discussed the coal supply in Indiana and said that the early storing of coal would help the situation in regard to the supply for the large companies. Other addresses were delivered by Charles Stuart, chief of the light and power division of the National Council of Defense, and Thomas A. Wynee, Jr., of Indianapolis.

CENTRALIZED ACTIVITIES OF NATIONAL ENGINEERING SOCIETIES.

United Engineering Society, Engineering Societies Library, Engineering Foundation, Engineering Council.

By Alfred D. Flinn.

Secretary, United Engineering Society, Engineering Foundation, Engineering Council.

Engineers and engineering assistants in the United States have been variously estimated to number from 100,000 to 300,000. In the memberships of the 17 societies having offices in the Engineering Societies Building, in New York City, and the 14 other technical societies holding meetings in that building regularly, are comprised approximately of 60,000 individuals, scattered all over the country. Of engineering organizations in America there are about 400, and of these possibly 100 merit places on lists of technical societies.

Engineers, as men of individualistic types, developing a profession in which new fields have been constantly opened by the advancement of science, have exercised their creative bent in organizing society after society. For many of these societies there have been good reasons; for others, no sufficient reasons. For few, if any, have well-considered schemes of organization and logical constitutions and by-laws been thought out. Until recently there has been little or no co-ordination or coherence among societies, no means have existed for united action, and no solidarity as a profession. No scheme has yet been completely elaborated for meeting local needs and coincidentally linking local and national societies properly. A suitable form of national organization has yet to be perfected. Only a few of the national societies have found ways of working together and that only recently.

Visits are being made to groups of engineers in many cities to discuss methods for making effective the power of organization so that, as existent in the engineering profession, it may be utilized for the good of humanity, the best development of our country and the advancement of the cause of liberty the world around, and not merely for selfish gains. We shall prosper best and most lastingly if at all times we sincerely seek to serve. Our country's aloofness has been broken. As a nation we are rapidly accepting a leading part in world affairs. Surely, then, the profession which has always been on the pioneer front (actually and metaphorically) in our own land, must lead in carrying into other lands the American gospel of individual opportunity and fair play.

The greatest obstacles in the pathway to harmony and solidarity are those valuable qualities of the engineer's character—his fertility of mind, his individualism and his reluctance to compromise. However, the increasing interest in these matters and the endeavors to solve the problem are encouraging. The war has given impetus to the efforts toward unity. In the first endeavors of engineers to serve our country by taking that large part in services which were recognized as being within the province of our profession, great confusion arose because of the multitude of organizations and individuals claiming to represent the profession or portions of it in proffering assistance to the Government. There was no generally representative council or other body, no adequate basis for co-operation, no instrumentality for united action in even so vital a matter as a war threatening the existence of the nation.

We must plead guilty to being but an imperfectly organized profession; nevertheless, during the past fifteen years, and particularly the last two or three years, notable progress has been made. Fifteen years ago several national technical societies which are rapidly becoming of great importance, had not been organized and the branches of the profession which they are developing were literally in their infancy. The automotive and aeronautical engineers are particularly striking examples. Of the four oldest national societies, commonly recognized as the principal engineering organizations of the country, the American Society of Civil Engineers, American Institute of Mining Engineers, American Society of Mechanical Engineers, American Institute of Electrical Engineers, only the first named had a suitable permanent home.

Engineering Societies Building as Concrete Instance of Co-operation Among the Societies.

In March, 1904, Andrew Carnegie offered $1,000,000 for the erection of a suitable building in New York City for the use of the National Engineering societies and $500,000 for an engineer's club.

For many years among thoughtful men of the engineering profession, there has been a growing appreciation of the need for a more comprehensive and effective organization, together with a conviction that notwithstanding the advantages accruing from the creation of separate organizations to meet the needs of important new branches of engineering work, something of great value has been sacrificed to these separations and the relatively small groups which have resulted. Attempts to draw together have been made from time to time.

Even before the founder societies agreed to live together, they joined in 1902 in honoring a great engineer and industrial leader, a man great for his fine qualities of heart as well as for his masterfulness. In forming the John Fritz Medal Board of Award, the four societies undertook their first continuous united activity. This medal, awarded annually, is now regarded as the highest honor which can be bestowed upon an American engineer. The board is composed of sixteen men, four from each society.

Formation of the Engineering Foundation. Promotion of Engineering Research.

In 1915 another man, widely beloved among engineers, Ambrose Swasey, of Cleveland, Ohio, a man of broad sympathies and far vision, cemented a third bond of union by giving $200,000 as the nucleus of an endowment fund for the Engineering Foundation. On the Board of sixteen members, created to perform the work for which the fund was given, all four founder societies are equally represented. It is the hope that this fund may be greatly increased as the Foundation undertakes important new lines of work.

In 1916, to aid in scientific and engineering preparations for war and to promote the nation's development in the years of peace, the National Research Council was called into being by the Government through the National Academy of Sciences. To provide a home and support for this young child of the union of engineers and scientists, Engineering Foundation became its foster mother and nurtured it for a year. The National Research Council is now, by executive order dated May 11, 1918, permanently established and is the Department of Science and Research of the Council of National Defense. It has offices in Washington and has been provided with large funds for the important work of many varieties upon which it is engaged for the Government, as well as for scientific and industrial research. The Council has branch

offices in London and Paris officially connected with the American embassies. Close relationship is still maintained between the Engineering Foundation and the National Research Council.

Engineering Foundation, co-operating with the National Research Council, has undertaken the promotion of industrial and scientific research throughout the country. The importance of such research is becoming well understood in these war times when new means for supplying old needs as well as new ones are constantly being sought by manufacturers, the Government and the public.

Engineering Council's Activities in Co-ordinating War Work by Engineers.

Engineering Council is the form of organization adopted after several others for combining the interests and activities of engineers in non-technical matters had been tried and found insufficient. Joint committee work had been attempted in a few instances, but the creation and operation of such committees had been found slow, cumbersome and otherwise unsatisfactory. The time consumed in getting such a committee to work, and limitations put upon its authority were forbidding. A standard joint committee to deal with certain kinds of subjects was tried, but could not meet the need. Engineering Council is an organization of national technical societies of America, created to provide for consideration of matters of common concern to engineers, as well as those of public welfare in which the profession is interested, in order that united action may be made possible. The Council is one of the most important expressions of the new order of things among engineers, and is the product of endeavors to deal with affairs other than those which have been denominated technical. It is the Council's aim to represent and to serve professional engineers throughout America and thus to advance the welfare of all mankind.

Engineering Council's organization meeting was held June 27, 1917. War with Germany having been declared in April, attempts to aid the Government in connection with the war occupied a large place in the early work of the Council.

The Council conducts its work chiefly through committees and the office of its secretary. The Public Affairs Committee reports on matters of public policy and those relating to national, state or local government other than engineering and scientific questions. It has prepared preliminary reports upon water power, patents reform, the licensing of engineers, the relationships of engineering schools to the military service and the draft, and upon numerous other important items. In several cases its preliminary investigations have led to the establishment of permanent committees to deal with specific lines of work.

American Engineering Service was one of the first committees appointed, the intention being to have it catalog the engineers of the country with sufficient information about the individuals to be prepared to assist the Government in finding engineers for all services, to assist engineers in finding suitable engagements in private as well as Governmental work and to supply biographical information for numerous purposes. This committee has available, through the co-operation of a number of societies, extensive classified lists of technically trained engineers in all parts of the country, from which approximately 5000 names have already been furnished the Government and other inquiries, for military and civilian engagements. From these lists a great many appointments have been made of all ranks, including some of the most important positions in the technical war work. Direct relations are maintained with the War Service Exchange of the War Department, which has been created to handle all personal needs of the various bureaus of that department. The Service is also officially recognized by the Navy Department. Both departments call upon it frequently for assistance not only in finding individuals for specific positions, but for large numbers of men, as for the engineer regiments and the tank corps of the Army, and for engineer officers of battleships, destroyers and submarines. Important service has been rendered also in the aeronautical branch of war work. The Service is prepared to supply names of civil, mechanical, electrical, mining, metallurgical, chemical, refrigerating, heating and ventilating and other professional engineers and assistants. It has a small paid office staff for routine work and holds regular weekly meetings to consider special problems and matters of policy. With the co-operation of one or another of the founder societies, recruiting of technical men for special assignments has on a number of occasions been carried on in Engineering Societies Building by officers of the Army and Navy.

The War Committee of Technical Societies, having 18 members selected from nine organizations, is engaged upon the examination and stimulation of new inventions and upon kindred work for the Government. Many of its assignments are of such confidential nature that they may not be so much as mentioned publicly. Its chairman, D. W. Brunton, is a member of the Naval Consulting Board and the only civilian member of the Executive Board of the Inventions Section of the Army. General Staff; his headquarters are now at Washington. Offices for this committee are maintained in New York, in connection with those of the Naval Consulting Board.

Fuel is one of the most vital necessaries for war and also for peace industries. As a people we have been most prodigal in the consumption of our natural fuel resources. The economies which it has become necessary to inculcate are largely engineering problems, for those which will count for most are to be effected in the industrial establishments and the transportation systems of the country. Several months ago, therefore, Engineering Council established a Fuel Conservation Committee to collaborate with the Bureau of Mines and the Fuel Administration on the broad policies of fuel utilization and economy. At the Worcester meeting of the American Society of Mechanical Engineers in June, one of the most largely attended and important sessions was conducted under the direction of the chairman of this committee, Prof. L. P. Breckenridge, and brought forth a collection of about 80 papers and discussions by well informed men. These papers have been printed in a special supplement of the Journal of the American Society of Mechanical Engineers and constitute a valuable book on this subject.

Improvements in the practice respecting patents have been proposed both by the United States Patent Office authorities and by engineers at large. To aid in this work, Engineering Council has appointed a Patents Committee to investigate reforms in the United States patent system and in the use of experts in litigation wherein the validity of patents or other technical matters are involved. It will co-operate with similar committees of the National Research Council and the other technical societies and with the Patent Office.

Believing that occasion might arise for Engineering

Council to care for matters of common concern to engineers in uniformed and civilian service of the Government in connection with the war, during both war time and the period of reconstruction, a small special committee was appointed to suggest the organization and duties of a Military Aid Committee to be created whenever the demand for such services should become sufficiently definite. A few engineer regiments have associations of relatives and friends in this country looking after their needs. Engineering Council would be pleased to receive suggestions from engineers in portions of the country distant from New York concerning services which could be performed for other engineers in the war and methods for financing them. Mention should be made in this connection of the Professional Classes War Relief of America, on which the engineering societies are officially represented. The functions of this association are to care for dependents of professional men who have been so deprived of income through the effect of the war as to need assistance for education of children or for maintaining a simple decent standard of living.

Water-power development has been receiving active consideration by Congress and the attention of the public because of the shortage of fuel has been turned more acutely to the possibilities of water power. Engineering Council made a valuable contribution to the discussion of this question through a notable paper presented by Calvert Townley, one of its members, to the Chamber of Commerce of the United States, and used by that Chamber in its referendum, sent to all local Chambers of Commerce in the country last winter. But power development is only one phase of the great subject of the utilization of water. To be broadly prepared, Engineering Council has created a Water Conservation Committee, of men well informed in the several branches of the subject. By this means it is expected that the Council will be ready to deal with broad questions of policy which may arise in any part of the country in connection with the utilization and control of water for municipal supply, power development, navigation, irrigation, sewage disposal, flood prevention and other purposes and to promote such consideration of water resources by Congress and legislatures as will result in conservation through wise use rather than unintelligent restriction or appropriation to a narrow use at the expense of some more important use.

To aid the Council in keeping informed of matters of interest to engineers throughout the country and in communicating to engineers the activities and purposes of the Council, a Publicity Committee has been authorized. In addition to a small group in New York, which can constantly assist the secretary in reviewing the more important engineering journals and preparing material for publication, it is intended to select corresponding members of the committee in a number of engineering centers, who will keep the New York office informed of local interests and opinions on questions of general concern and will likewise aid in informing the local engineering organizations of the work of the Council.

Licensing of engineers and architects has been a matter for discussion in the legislatures of a number of states and will be under consideration in one or more states in all probability during the coming fall and winter. In a few states laws have already been passed. In order to collect and digest information on this subject and to be prepared to assist the engineers of any state in connection with proposed legislation, Engineering Council is organizing a committee carefully selected to secure sufficient geographical representation and to be composed of such men as would give weight and contribute sound opinions to the work of the committee.

Membership on the committees of Engineering Council is not restricted to the representatives on the Council, although usually the chairman or at least one member of the committee is representative. In the main, the committees are made up of the older members of the profession who have had large experience in the activities of the societies.

Although Engineering Council was created by the civil, mining, mechanical and electrical societies, it was intended that membership should not be restricted to these organizations. Procedure has therefore been adopted for the admission of other national engineering or national technical societies—national in the scope of their activities and not by title identified with any state or municipality—and devoted to the advancement of the engineering arts and sciences.

Engineering Societies Library.

Engineering Societies Library is the consolidation of the former separate libraries of the founder societies augmented by subsequent purchases and gifts. It contains about 130,000 books and pamphlets and is growing constantly. A recent important gift is the library of the Board of Patent Control of the Westinghouse and General Electric companies, containing 9000 carefully selected volumes relating to electrical patents.

Engineering Societies Library is the largest and most important technical library in the western hemisphere and probably in the whole world. The ideal which the managers of the founder societies had before them, when they combined their individual libraries under the United Engineering Society was to make a library which would contain everything that an engineer would find useful in his work, to eliminate the unnecessary duplication and cost occasioned by separate libraries, and to obviate the necessity of visiting several libraries to collect all the data on a subject. It is believed that the united institution is easier to use, is more efficient and can do its work more cheaply than four independent libraries. It is making every effort to keep abreast of modern developments. While not within sight of its ideal, certain fields are quite thoroughly covered and attention is being directed toward improving the weaker sections.

The library, we feel, is only at the beginning. Many ways in which it can be improved are apparent. It hopes to classify and catalog the collection better, to make its collection stronger, and to broaden its scope. It hopes to improve its search service, and will do so as the collection increases. It has a dream of the preparation of a really comprehensive index to engineering literature, and the further dream that the publication of this may become possible. It has, in fact, a half century of work planned.

Its needs are two—more money and more skilled workers. More money means an opportunity to do more things for the benefit of engineers; more skilled workers, the ability to do them better. The war has hit the libraries, as well as other institutions. We find that skilled men have been drawn into other lines, and that competent searchers are hard to get. Until the war is over this shortage of men with sufficient technical training will continue to hamper us, but we shall give the best service that we can and try constantly to improve it. The library desires to be of service in any possible way.

Commercial

War-Time Electricity Rates in Indianapolis—Record Appliance Sales in Houston—Motor Drive in Newburgh Shipyard

WAR-TIME ELECTRICITY RATES IN INDIANAPOLIS.

Indianapolis Light & Heat and Merchants Heat & Light Companies Granted Rate Increases.

War-time rates for electric light and power and for steam and hot-water heat supplied by the Indianapolis Light & Heat Company have been established by the Public Service Commission of Indiana as follows:

LIGHT RATES.

Primary rate, 7 cents. Unchanged.
Secondary rate, 6 cents. Raised from 5 cents.
Municipal light rate, 5 mills surcharge. Same as last year.
Monthly minimum, 50 cents. Unchanged.
Effective for the period of the war, or not to continue beyond December 31, 1920.

POWER BILLS.

All power bills, 7 mills surcharge. Raised from 5 mills last year. Effective same as light rates.
Monthly minimum, 1.65 cents a kilowatt-hour. No kilowatt-hour minimum basis formerly. Effective from date and permanent.
Steam and hot water heat rates receive a 50 per cent surcharge to all bills, compared with 25 per cent last year.

It will be seen the small light consumers, numbering about 45,000, in home and office, will be unaffected by the rate increases, it being the large users that will be affected.

In analyzing the cost of power current production the commission, in its own language, found "some very interesting revelations."

"It revealed," reads the order, "that consumers being served under the 'additional power rate,' which is a wholesale rate, have been a constant source of loss. Under the original rates these consumers, which are the largest power users, were sold current at .0057 cent, or a little less than 6 mills. The 5-mills surcharge applied last winter raised the return to 1.06 cents. The bare-bone cost of providing the plant, keeping it in condition and producing this electric energy, will be approximately 1.85 cents."

Therefore, the commission, yielding a little, fixed the minimum power rate at 1.65 cents. This rate applies also to all current uses for company purposes.

In granting the surcharge of 7 mills to power bills, instead of 5 mills, as it was last year, the commission declined to yield to the companies' requests for a surcharge of 1 cent. It held the present power rates unusually low, partly because of the competition between the two companies, "which has been keen and even foolish." Such power consumers, the commission held, "are enjoying unusual war profits for their commodities and there is no reason whatever to supply them with the essential element of power at a losing rate, while they are free to reap any measure of high selling prices that may be prevalent."

"If further relief from financial hardships of the war period are sorely pressing on the petitioners," reads a part of the order, "such relief should be obtained from correction of conditions by petitioners themselves.

"In the electric field occupied by petitioners there was no great objection, in normal times, to duplications that assume different importance in these days, when operating costs make it necessary for these utilities to seek relief and when they seek all the relief at the expense of patrons served. In this war period there must be taken into consideration by the commission the existence of two complete institutions and inevitable duplication of at least certain heavy overhead expenses and also losses or wastes arising from failure to co-ordinate operation of five different plants such as would be the case under a united war-period operation.

"There has existed, at least until a very recent period, a competitive rivalry or war of extermination that has known no bounds and that has been wasteful in many ways. Petitioners urge that under an understanding recently reached competitive solicitations and practices are to be held in abeyance, but an analysis of the estimates for the year ending June 30 reveals that in terms of accounting, under which such competition—from advertising to solicitation and throwing out each other's meters—is carried, show increases instead of decreases, although the increases are not large. The conditions are such, however, that there is a constant waste of labor and money that is not compatible with the period of economy in which the country is now living.

COAL WASTE SINISTER SIDE.

"The real sinister side of these conditions now is coal waste. Consulting engineers of repute and managers of other utilities have placed as high as 75,000 tons a year the unnecessary use of coal arising from no connections between and no co-ordination in the operation of the five plants of the petitioners. While petitioners deny that larger consumption of coal could be saved, still it is admitted that 10,000 tons could be saved if there were physical connections and war-period pooling and readjustments, such as are being carried on at many other points. Even such a saving as is admitted would amount to the needless movement and use of 200 to 225 carloads of coal, or enough to meet the demands of a town of 2000 or 2500 persons.

"The Legislature in enacting the Shively-Spencer utility commission law in normal times, wisely did not place in the hands of the commission coercive powers of consolidation or pooling, but in meeting the unusual conditions now presented, such waste and other conditions press for consolidation. The commission is led to believe that some increases now called for as measures of relief would not be necessary if the services were unified either by one ownership or effective pooling for the period of the war. The commission is of the opinion that owners of these public utilities should not be permitted, under these conditions, to shift all the burden of waste and duplication and de-

ductions for certain of these losses are made in the conclusions of this order.

"Those financially interested in these institutions may increase their earnings by bringing them into unity, either by merging them or by practical pooling of interests for war-period operation. Such unification is certainly urged as a matter of economy directly in line with the general policies of economy that are now being applied nation-wide and if not done voluntarily, the Federal Government will be justified in taking steps to forcibly cause readjustments for the saving of coal, labor and materials.

DAYLIGHT SAVING MAKES GOOD FAN BUSINESS IN NEW ORLEANS.

The June sale of electric fans of the New Orleans Railway & Light Company broke all records, reaching a total of 297 as compared with 189 sold during the same month last year. The merchandising profit on these fans total approximately $2500, for there was practically no special expense entailed. The advertising program, while carried out in a careful and complete manner, cost almost nothing, as folders, bill stickers and window displays were furnished free by manufacturers and the distribution was made through boxes in street cars. The only other medium utilized was the little weekly folder *Service* of which the company regularly issues 20,000 copies.

The success in selling fans this season is of particular interest in view of the unusual conditions brought about by the daylight saving act. It was anticipated that this would result in a greater demand for fans because the men would return home from their offices earlier by the sun, and would spend an extra hour at home before retiring. The change from a fan-cooled office to a fanless home would make the need of a household fan more apparent and bring an increased demand that would not be discouraged by the higher prices this year. On the strength of this reasoning the New Orleans Railway & Light Company had stocked up with an extra large number of fans, and there is every prospect that they will dispose of them easily and to advantage.

RECORD APPLIANCE SALES IN HOUSTON.

Commercial Manager Clarke of the Houston (Tex.) Lighting & Power Company, reports that June recorded the biggest sale of appliances for any one month in the history of the company. In a single day $1,000 worth of fans were retailed and the small contract department was taxed to the utmost to take care of the contract work which resulted. The heat came with a rush.

A great deal of effort is being directed by the Houston company to the development of a more active merchandising business. The great increase in a number of stores in Houston and the rapid growth among the manufacturing industries which have been the result of the coming of the army cantonment, have made a more than normal drain upon the ranks of domestic servants. There are a very large number of homes, therefore, where the housewife herself is compelled to do her own work and this brings greatly increased opportunity for the utilization of electric appliances. The Houston Lighting & Power Company is endeavoring to bring the public to the realization of the relief which a greater dependence upon electric service will bring them in their homes, and the effect is being shown in a steadily increased sale.

MOTOR DRIVE IN THE NEWBURGH SHIPYARD.

Central-Station Service Economical—Interesting Features of Emergency Motor Installation.

The Newburgh (N. Y.) Shipyard, which will specialize on standard 9000-ton steel cargo vessels, is one of the new shipyards made necessary by the present war demands for all kinds of ships. A year ago the shipyard's site was a marshland, while today on made ground that required thousands of cubic yards of fill, there are numerous buildings and four shipways, while the actual construction of four large steel ships is under way. The launching of the first standard 9000-ton steel cargo vessel will take place this month and the other three ships will be completed soon afterwards.

The structural steel shop leads the various departments in active operation. The system of motor drive employed in the shop is of special interest at this time, because it is a typical example of the emergency war installation.

Some of the conditions which were taken into consideration in laying out the drive were as follows: (1) The machinery must be arranged to allow rapid and economical production. (2) The machines were to be managed by more or less unskilled men and they have to be safeguarded as completely as possible. (3) Time was a vital factor and as deliveries of special apparatus were at that time very slow, the best possible use had to be made of such available equipment as could be obtained within a reasonable length of time.

Power being available from the Central Hudson

Westinghouse Type CS Squirrel-Cage Motor Driving Hilles & Jones Horizontal Punch for Punching ⅞-Inch Holes in ⅞-Inch Plates. Type A Autostarter Used.

Gas & Electric Company, it was, of course, used in preference to erection of an isolated plant. This saved the labor to run it, eliminated the handling of fuel and ashes, and helped to economize on coal. In order to insure maximum output for each machine, it was decided to use individual motor drive throughout, and to provide complete flexibility as to the arrangement of the machines in the shop.

The central station supplies alternating current only, as practically all the machines in the shop, namely, the punches and shears, are of the constant-speed type and squirrel-cage motors are used exclusively. The only exceptions are the furnace blower and the bending rolls, both of which require speed variation. The furnace blower, which supplies air for the crude-oil plate and angle furnaces, is driven by a slip-ring motor with a drum-type speed controller. The bending rolls were originally driven by a motor-generator set, but due to the fact that this equipment was decidedly antiquated (war conditions making it impossible to secure modern apparatus at the time when it was wanted) a Westinghouse variable-speed, alternating-current motor has been installed to fill its place.

From the accompanying illustrations it can be seen that all the machines are belt-driven. This is not generally considered to be the best practice for such machines as a punch or a shear. Engineers generally favor mounting the motor on the machine and driving by means of gears. However, this type of drive requires special machine work and a special high-starting-torque motor, and had these been decided upon, it would have added months to the date of delivery of the equipment. For the above-named reason standard motors with belts are in use.

The high-starting-torque motors would have been desirable because of their considerable flywheel effect, but it was thought that the belts would slip enough in starting to relieve the motors of the excessive stresses that occur at this time, and so far this has proved to be the case, as none of the motors have given any trouble. This result has been gratifying to the engineers in charge, since time did not allow a power list to be made of each machine. The motors were selected largely by judgment and the supply of motors available for early delivery.

Westinghouse Type CS Squirrel-Cage Motor Driving 6 by 6 by ¾-Inch Hilles & Jones Angle Shears.

Wire screens carefully protect all gears, pulleys and belts. All of the motors that are started and stopped by the steel workers are controlled by automatic starters or oil switches, which have no exposed live parts and cannot be improperly manipulated by the most careless person. Protection against overloads and failure of power is provided for by automatic means.

General View in Structural Steel Shop, Newburgh Shipyard.

The central station supplies the current at 5700 volts. A small substation in the shipyard, which consists of a bank of transformers and a panel carrying the necessary switches and meters, reduces the voltage to 220 volts for use around the plant.

A HIGH RECORD IN SALE OF ELECTRIC RANGES AND HEATERS MADE IN SPOKANE.

Importance of Water Heater as Part of Electrified Kitchen—Revenues Produced By Ranges and Heaters.

Electric service for household appliances in Spokane and suburban towns, within the territory of Washington Water Power Company, eastern Washington, is best shown by giving a few facts as to electric ranges and electric water heaters in use: In the city of Spokane there are 1131 ranges and 798 water heaters; in the suburban towns, 1063 ranges and 603 water heaters, giving a total of 2194 ranges and 1491 water heaters on the lines of this company. Of the ranges and heaters named, the sales thus far in 1918 have amounted to 564 ranges and 751 heaters. About 75 per cent of the electrified kitchens include the water heater as well as the range and other electrical appliances. It is figured that the electric ranges sold produce an average annual revenue of $44 each and the water heaters a revenue of $27 each. The company reports that the sale of electric washing machines has amounted to about one machine per day.

SYNCHRONOUS MOTOR FOR MINE AIR COMPRESSOR.

The Wharton Steel Company has recently had installed a 350-hp., 2300-volt synchronous motor for driving an air compressor at its Scrub Oak Mine. This compressor will operate 24 hours a day, 7 days a week. The output of the mine is expected to be about 2000 tons of ore per diem when in full operation, some six weeks hence. The Wharton Steel Company purchases central-station service from the New Jersey Power & Light Company.

Operating

Transformer Troubles—Weather Effects on Labor—Linemens' Safety Staging—Motor Trouble—Emergency Signals

VULNERABLE PARTS OF DISTRIBUTING TRANSFORMERS.

Inspection of Which May Save Expense and Trouble of Changing Transformers.

By Allen M. Abbott.

The present season is one during which distributing transformers usually come in for the worst trouble during the entire year. High sustained temperatures effect high average temperature of the transil oil, and this in turn may result in overheating of a transformer if it be carrying heavy load, or loads ordinarily carried for long periods without trouble. And then again lightning is most frequently encountered during the present season, and is usually most severe.

The shortage of labor, the difficulties of finding transformers to replace those damaged, and the abnormally high cost of carrying out repairs, and also of course the desirability of maintaining service uninterrupted, makes it highly important not to take a transformer down off a pole and replace it by another unless absolutely necessary. Yet many a transformer has been taken down off a pole, carted to the repair shops, tested and found in good condition after simple overhauling, and shipped out again to the line, a series of performances always costly, and possibly unnecessary.

There are many ways of determining if a transformer is working or not before taking it off a pole. Every lineman is conversant with the ways of using lamp and fuse, watching for a spark, checking ratio, and so forth. However, many a transformer gives every indication of being burnt out when it is only temporarily short-circuited, a condition that may possibly be readily remedied.

It is often possible with very little experience to tell by looking inside a distributing transformer what is the matter with it, and how caused, whether the unit is burnt out and if so whether by lightning or overload. The writer has examined hundreds of distributing transformers that have been so-called burnt-out. Many were truly burnt-out by overload and damaged so badly inside the coils as to require entire re-winding. Many were punctured between turns in many places by lightning (as found later on taking down the coils) and also required rewinding. Many were, however, only short-circuited at their terminals, and only needed separation at the point of contact to make them ready for service again.

The odor and color of the transil oil tells the tale of the transformer burnt-out by sustained overload. The smell of the charred oil is pronounced and lasts for weeks very often. The oil is not worthless, however, except in exceptional cases, but may be renovated and made fit for service again either alone or when admixed with uninjured oil.

A frequent cause of trouble, showing up as a short-circuit, is that of bridging between the high-voltage terminals. Terminal blocks are frequently made of porcelain. The discharge of lightning, followed by dynamic current, fuses the porcelain between ends of the coil at the terminal, the melted copper or brass also melts, vaporizes and condenses on the porcelain, thus bridging across between terminals. After the fuses have blown, or the circuit opened at the station and has been closed again it will be found that the terminals are still bridged across by a conducting path of copper or brass film. It is often possible by means of a hammer or a pair of pliers to break the porcelain and thus have the transformer in fit condition again for service.

In a case of trouble with a distributing transformer it is well to take off the cover and make at least a cursory inspection with a view to finding out if the transformer actually requires being taken off the pole and replaced, or not. Doing so will save time, save perhaps prolonged service interruptions and save money.

WEATHER CONDITIONS AND LABOR EFFICIENCY.

Influence of Temperature on Cost of Doing Linework Pointed Out.

By A. G. Drury.

It is common experience that men can do manual work most effectually in weather that presents the least physical discomforts; especially is this true in the case of outdoor construction. In cold weather, time and energy are taken from the actual work of construction to warm the body and the tendency is to linger till the last moment around a fire, while in very hot weather the strength is dissipated, all of which costs a company money. Public utilities recognize this in a general way by doing comparatively little work during the severe winter months, but generally speaking this is in consideration of the voiced objections of the men rather than from a scientific economic study of conditions. Since it is true that men work less efficiently in extremes of temperature, it also follows that during certain periods they work most efficiently. Moreover, if money is now being saved by doing less work under unfavorable circumstances, we are only attacking half the problem, unless more work is attempted under the most favorable conditions. This matter has been studied considerably as to office and home conditions, and we are advised to keep a room temperature between 65 and 70 in winter for office work and about 70 in a home.

Of course, it would take an infinite amount of data to establish rules along this line, in outdoor work, but with the price of labor mounting and very little prospect of a decline in the near future, even after the war, anything that could be accomplished along this line is just so much saved. As an example, the cost

of labor on construction of similar jobs over a period of three years has been taken in the following. In order to effect a fair comparison, the cost was modified by reducing 1916 and 1917 wages to the 1915 scale. For instance, labor of ground men cost 22½ cents per hour in 1915, 25 in 1916, 30 in 1917. To equate the labor cost in 1916 to 1915, multiply by $\frac{22.5}{25}$ and for 1917 use the factor $\frac{22.5}{30}$.

The following is a table of average costs of labor over the three years for the installation of one pole and about twelve hundred feet of wire and the average of the mean monthly temperature for those months taken from the report of the United States Weather Bureau.

The months having approximately similar temperatures are grouped.

Month.	Cost.	Temperature, Deg. F.
December	$12.05	26.9
January	12.07	35.0
February	12.21	29.3
Average 3 months	$12.11	30.4
May	11.00	60.5
June	9.70	66.6
Average 2 months	$10.35	63.5
July	11.34	76.3
August	11.15	79.0
Average 2 months	$11.25	77.7
March	11.01	40.9
April	10.73	51.4
October	9.22	51.4
November	6.62	43.4
Average 4 months	$ 9.39	46.8

An isolated case in the above table. In December of 1917 the mean monthly temperature was 22.2, the coldest December on record—having several days when the thermometer registered below zero. The cost for the small amount of work done during this month averaged $19.10 per pole and 1200 feet of wire.

Evidently, during the period considered, the most efficient work was done under a mean temperature of 46.8 deg. F. Using this as a basis and assigning the cost of construction during the period as 100 per cent, gives the following table of:

Time.	Cost.	Per cent cost.
Spring and Fall months	$ 9.39	100
May and June	10.35	110
July and August	11.25	120
Winter months	12.11	129
Extreme of December, 1917	19.10	203

Take an average example, when the cost of labor is about one-fifth the cost of the entire job, say, $100 on a $500 job. By doing the work in November, which would not be needed until January, $29 would be saved. Balance against this interest, depreciation, etc., at 20 per cent per year (which is high) or 3.3 per cent for two months, which on $500 equals $16.50. This is a proposition which presents different factors in different localities and would have to be worked out individually for each place. Practically, however, it seems that the anticipation of severe weather, by putting up work even a month or two before needed, is a paying proposition financially—also the appreciation of the consideration for the comfort of the workmen, and during the present time a satisfied efficient lineman is at a premium.

SAFETY STAGING FOR LINEMEN.

Application of Safety Device to Transmission Line Structures.

One of the factors, perhaps the chief, contributing to the dangers of working on live wires from poles is the way in which the linemen have to fasten themselves to the pole, the difficulties of working under such conditions, and the cramped space and inability of the men to move around freely. These factors combine to make work that in any case would be dangerous still more dangerous. And these factors also necessarily make the work slower to execute.

The accompanying illustration shows a form of pole staging employed by many progressive companies for protecting their men against the usual disadvantages and hazards of working on a pole while strapped to it. The staging is raised and fastened in place securely, after which the lineman has ample room in which to move around, and, being free, is able to devote his attention entirely to the work in hand without troubling about whether his climbing irons are properly lodged in the pole, the condition of his belt, and so forth.

Bush Linemens' Staging in Use on 55,000-Volt Pole Line.

The staging is of iron, because of the weight that may have to be supported. In addition to the staging, wooden guards are seen to be in use between conductors. These barriers prevent conductors when untied from their insulators from swinging together and also act as a fence to keep the man on the stage from making accidental contact with the conductors. Many of the western companies operating high-voltage transmission lines, who have felt the shortage of labor acutely while being called upon to make prompt repairs to lines in trouble are using this form of staging because it saves time, and, most important, protects the men from mishap.

This staging is the invention of H. B. Bush, an experienced lineman and general electrician of Redlands, Cal. He has also invented linemen's tools, including wire cutters for unwrapping tie wires on insulators preparatory to changing the latter, a tool for tapping a branch onto a live high-voltage line, a ground clamp and temporary tap, a fuse grabber, an all-steel pole support, paint receptacles, etc.

INCREASING MOTOR CAPACITY BY CHANGING PULLEY DIAMETER.

Application of Old Theorem Solves Practical Problem.

By F. M. Baker.

A motor-driven pump has been installed alongside a railroad track to replace a steam-engine-driven pump. The pump was for supplying water to a storage tank for furnishing water to locomotives. The motor-driven pump would, it was estimated, save considerable trouble, since being automatic, personal supervision could be largely dispensed with. Coal would also be saved and all the other troubles incident to the use of steam eliminated.

However, the motor-driven pumping outfit gave trouble, in that it was claimed impossible to obtain the needed delivery of water. The rating of the pump when checked up with the working head against which the pump had to work, the diameter of the pipes, etc., showed that the pump was the right pump for the job. The name plate on the motor also indicated that it was about the right size for the pump.

Electrical measurements showed that the motor was able to work at full load, and then would gradually stall as the pump slowed down until the fuses in the motor circuit blew. The water pressure was found to be about half that guaranteed for the pump.

It was apparently a case of overload on the motor or where the "rate" of doing work was excessive, and on this basis the writer determined to change the size of the motor pulley. This was done, the motor pulley being, in fact, reduced 40 per cent, and the foundation for the motor changed accordingly to permit efficient use of belting. On starting the unit up, the pump manufacturer's guarantee was more than fulfilled, and the motor operated satisfactorily. The difficulty was due, obviously, to the rate of work being excessive at the first, due the wrong selection of motor pulley diameter. The fact that the rate of pumping was reduced did not matter, fortunately, because the water storage tank had ample capacity, and by keeping the pump at work longer, which also means higher load-factor, the tank was kept full within the prescribed limits.

EMERGENCY SIGNALS FOR EMERGENCY STARTING.

How Denver Gas & Electric Light Company Starts Up and Carries Full Load on Short Notice.

Operating conditions are such that the West Side generating station of the Denver Gas & Electric Light Company must be prepared to start up and carry full load within a few minutes, and without previous notice, a condition typical with stand-by service and where long distance transmission supplies an important load. To permit of this, so that starting up and picking up the load may be simplified as much as possible, thereby eliminating needless instructions and explanations, a complete set of signals have been devised for use of the West Side operating staff such as will meet any emergency. By means of bells, whistles, automobile horns and speaking tubes all sections of the plant can be reached by the switchboard operator.

The major portion of the load is carried by the Colorado Power Company, and when it "goes out" the switchboard operator pulls a cord; this causes one blast of the big whistle. This brings everyone to "attention" and the furnace tenders immediately start up the oil burners under the boilers and commence to stoke in order to maintain steam, while turbine No. 3 or 6 picks up its load. If the whistle fails to blow, the operator touches a button that rings a large bell in the boiler room. In the meantime, if the operator wishes to speak to the engineers, automobile horns or bells bring them to convenient speaking tubes.

A particularly interesting feature of this system is the lamp signal on each of the two main turbines. Electrical connections have been placed on each valve, and as a valve opens it lights a lamp in a row of lamps placed in the boiler room. It is customary to keep one turbine floating on the line with only one valve open. As the turbine picks up its load one valve after the other will open, lighting the lamps in the boiler room. This gives the fireman notice in advance of how much stoking is necessary, reduces interruptions, eliminates mistakes and loss of time, and also saves the coal pile.

EFFECT OF VIBRATION UPON ELECTRICAL MACHINERY PERFORMANCE.

By A. F. Seymour.

Few realize the costliness of vibration, a cost that appears more than ever unwarranted when it is remembered that vibration can usually be overcome or prevented.

The effect of vibration upon insulation is always the same eventually—disintegration. How long is required to cause deterioration of the insulation, and how long after that may elapse before dielectric failure occurs are matters that vary. But the result is the same, eventually. Insulation chafs, turns short-circuit, capacity is reduced, it is impossible to maintain voltage and machines become inefficient and fail.

Vibration jeopardizes commutation. Brushes move back and forth from the commutator, causing sparking, which becomes cumulative in effect and the surface of the commutator and brushes become worse. Machines flash over, overheat and if not burning-out may still become inoperative. Vibration is a frequent source of commutation trouble, as well as high cost of operating.

A SUBSTITUTE FOR CORRUGATED IRON.

In Great Britain is now being manufactured a substitute for corrugated iron sheets, composed of asbestos and cement. Asbestos is finely ground and freed from extraneous matter. It is then mixed with cement in the proportion of 1 part asbestos to 6 parts of cement, and wetted down to form a mixture. The mixture is passed through a pressing machine similar to a paper-making machine with a large revolving drum, where it is formed into felts or sheets. After being cut to size these sheets are corrugated under pressure, meanwhile care being taken that the tops of the corrugations are as strong as the remaining portions of the sheet. Finally, the sheets are given a seasoning treatment.

Corrugated sheets of the above materials, says the Brass World, have durability and resistance to climatic conditions, especially in acid-laden atmosphere so detrimental to corrugated iron. The sheets are also fireproof and poor conductors of heat. The use of these sheets in storage battery rooms, where conditions are extremely severe, for partitions, for separating high-voltage apparatus, store partitions, etc., and for cables and even transformer vaults, as well as roofing, seems worth while investigating.

Contracting-Construction

Electrical Estimators' Association Doing Valuable Work—Manufacturer Adopts Goodwin's Ideas—Among Contractors

ORGANIZATION AND WORK OF THE ELECTRICAL ESTIMATORS' ASSOCIATION.

Standardization of Estimating and Other Important Benefits to Electrical Contracting Fraternity from Its Activities.

Careful preparation of an estimate on which to place a bid for proposed contract work is one of the most important things an electrical contractor has to take care of in order to insure success in his business. If the estimates are only haphazard guesses and are very low, the contractor will lose a lot of money on his contracts; if they are very high he will never get any contracts. In either case his business is likely to be ruined. Lack of scientific estimating is unquestionably the cause of much of the evil practices and ill repute that the electrical contracting fraternity has been the victim of.

While these self-evident truths have been recognized among contractors for several years, it is only in recent months that an approach to a solution of them has been arrived at. This solution is being worked out through an association of estimators connected with the most prominent contractors in Chicago, who have perfected a very simple but effective organization, which is unique in being not only the first of its kind but also in the amount of good work accomplished in so short a time. A brief history of this organization is therefore of timely interest.

Formation and Objects of the Association.

During last winter a glaring case of wide divergence in estimating was brought to light in Chicago when the bids on a fairly large contract were opened. It was found that they varied by over 100 per cent, which naturally created a bad impression of the business ability of the competing contractors and caused considerable discussion among them as to how it was possible for such extreme differences to exist unless the system of estimating used by some of the firms was entirely wrong or their estimates were full of errors. It was finally decided to place on the estimators the responsibility for finding these particular errors and the faults in the system of estimating as a whole, consequently an informal conference of the chief estimators of the competing bidders was called. This conference was attended by some half dozen estimators, who although they had heard of each other had never met and were almost entirely unacquainted with one another. The causes of the great differences in the particular case were soon discovered and the conference had such mutually satisfactory results that it was felt to be to the interests of all the estimators and the firms they represented to meet again for further discussion of their problems.

On February 6 a luncheon meeting was held by ten estimators at which it was decided to form an organization to bring the men together socially and thus mutually add to their efficiency. It was decided that any man estimating electrical work should be eligible as a member of the association; that any men earning their livelihood in this manner should be invited to attend the dinners and join the organization; that the purpose of the association should be the betterment of its members, thus indirectly aiding the firms they worked for; that no contracts or work not yet closed should be in any way discussed; and finally that the new organization should be independent of any organization that exists among their employers. The association was completed by the election of George Carlson as president and C. D. Campbell as secretary.

Soon after the organization began to hold regular meetings, which are luncheon meetings, on the first and third Thursdays of each month, President Carlson was called into Government service and at about this time also Secretary Campbell suddenly died.

In place of these gentlemen there were elected the following: President, A. McWilliams; secretary, John R. Smith. Both these gentlemen are actively serving the organization. The association is unique in having no constitution and no by-laws.

One of the first subjects taken up as the regular meetings got under way was the subject of labor data. The members placed at the disposal of the association a large mass of practical data of the utmost value to electrical estimators that they had collected during their experience in the contracting business. Systematic estimating also was discussed and various shades of opinion were presented.

At about this time the labor committee of the National Association of Electrical Contractors and Dealers, through its chairman, J. N. Pierce, of Chicago, heard of the work of the estimators' association and asked that the data which had been gathered should be compiled into the form of a paper and presented at the annual convention of the National Association in Cleveland in July. This the estimators' association consented to do and in order to get the data and supplementary matter into the form of a presentable paper, work was concentrated on this matter and a large number of the members spent many evenings a week for a period of some five or six weeks in completing the data and the text of the paper.

This paper, which was published substantially in full in the Electrical Review of July 27, pages 125-131, aroused very keen interest at the national convention in Cleveland, and it was the consensus of opinion that the data presented were probably the most valuable that had ever been brought before the National Association. This was because the data were based on actual experience and represented average conditions in a very large number of installations and in the case of some of the data differentiation was made between simple and difficult work. Although labor cost data had been prepared before, these had been based largely on stop-watch studies and were by no means typical of general conditions.

The Electrical Estimators' Association is continuing the collection of labor cost and other data of value to the industry and is also working now actively on the preparation of standard forms for estimating. It is believed that the preparation of these standard forms will be of extremely high value in standardizing the system of estimating and making the comparison of estimates much more convenient for the contractors.

The association is proud of its achievements and is hopeful of extending its influence to other cities. Already some negotiations are under way for forming local chapters in several cities where the work of the association has become known. In view of the unique character of this organization and its work, a list ot its members, all of whom are located in Chicago, is no doubt of interest.

These members are as follows: Arthur J. Bruen, G. E. Carlson, E. F. Edgecombe, Jr., A. L. Evans, O. E. Fuchs, M. E. Hill, Ernest Howard, V. E. Jefferson, A. R. Locke, R. S. McMillan, A. McWilliams, P. C. Moore, E. L. Morley, R. A. Morrison, H. C. Newkirk, A. G. Ofenstein, E. E. Protheroe, Robert Protheroe, W. T. Slausen, John R. Smith, A. G. Soderberg, F. S. Spitler, E. J. Steiner, Albert Uhl, J. P. Zsymanski.

A distinct feature of the organization is that it has removed the suspicion and envy which has characterized the relations of electrical estimators formerly and has replaced them by comradeship and mutual trust so that it may be said that it has put "mate" into estimate.

MANUFACTURER OF LIGHTING EQUIPMENT ADOPTS GOODWIN PLAN DISCOUNTS.

Wide Scope and Equity of Mr. Goodwin's Ideas Being Recognized by Ivanhoe-Regent Works.

Much gratification is being expressed by contractor-dealers at the friendly spirit shown by various electrical interests outside their own circle toward the Goodwin Plan of revolutionizing the retail merchandising branch of the electrical business. More and more, jobbers and central stations are recognizing the contractor-dealer as the logical retail distributor and are giving him the status he deserves. Now comes the pleasant news of a large manufacturer showing similar recognition of the soundness of Mr. Goodwin's ideas by developing a constructive selling policy.

It has been the custom for manufacturers of industrial lighting equipment, as well as for manufacturers of similar products, to give the best discount to jobbers and local distributors without making any distinction in discount between the contractor-dealer and the industrial-plant consumer. The Ivanhoe-Regent Works of General Electric Company, however, after a study of the Goodwin Plan, has come to agree with Mr. Goodwin that the present organization of the electrical industry is necessary to an economic distribution and merchandising of electrical material, and that each of the units composing the electrical industry—central stations, wholesalers, contractor-dealers—are entitled to recognition and assistance from the manufacturer. Beginning on August 15, 1918, the Ivanhoe-Regent Works puts into effect an arrangement whereby its merchandising and distribution scheme conform to the Goodwin Plan. Under this arrangement the jobber and distributor will receive his discount and the consumer who buys in quantities will also be permitted a discount as before, but the new plan provides a discount on Ivanhoe metal reflectors and fittings to the contractor-dealer.

AMONG THE CONTRACTORS.

Among the contracts completed some time ago by the Billings Electrical Supply Company, of Billings, Mont., was that for all electrical work on the new Hart-Albin building in that city, amounting to $10,000. Wires were laid in conduit throughout, and 1000 outlets were provided. Motors, to operate at a voltage of 220, were put in for ventilating fans, and equipment for vacuum cleaners was arranged for. Sechrist lighting fixtures were installed by the Billings company.

The Central Electric Company, of Billings, Mont., has under contract the wiring and motor installations in the Kate Fratt Memorial School of the Catholic church, and similar work on the new brick warehouse of Swift & Company, at Billings, in which there will be 125 outlets. Included, also, may be mentioned the wiring, installation of lighting fixtures and other electrical work, incidental to the remodeling of the Yellowstone National Bank Building.

The following contracts have recently been awarded to Russell & Company, 56 West Forty-fifth street, New York City: Electric lighting installation throughout the new apartment building to be constructed at 3 East Forty-seventh street, for the Golet Estate; this contract also includes a system of telephones and bells. Contract for lighting installation in a similar building at 52 West Fifty-second street, Wm. Watson, owner. Electric wiring throughout the old St. Mark's Hospital, opposite St. Mark's church; this building is the old Stuyvesant mansion and was built 150 years ago; the work involves the installation of electric lighting and also a silent call system for the nurses. Installing electric light and bell work throughout the apartment building at the northwest corner of Ninety-third street and Lexington avenue. Also the power wiring and fixture installation throughout the new factory building for P. Lorillard Company, tobacco manufacturers, at Ninetieth street and Lexington avenue. All of these buildings are in New York City.

The Massillon Engineering & Electric Company, of Massillon, Ohio, has been recently organized and chartered and has taken over the J. C. Lewis Electric Company of that city. Mr. Lewis will be connected with the new firm as president and general manager, while the inside business management will be under Roy M. Bayless, secretary and treasurer of the company and recently superintendent of the Reliance Manufacturing Co. The present directors are: Floyd C. Snyder, of the Reynolds Machine Company; Edison W. Hart, of the Reliance Manufacturing Company; C. C. Miller, Joseph C. Lewis and Roy M. Bayless. While the Lewis Electric Company has enjoyed a steady growth, the new organization will provide adequately for this growing concern which has been somewhat handicapped for lack of working capital, while the excellent directorship assures the new company's successful development. In addition to general contracting and repair work, the company will have a completely equipped storage-battery plant and magneto and ignition testing equipment, and will operate a wholesale as well as retail department, and will also act as jobber for manufacturers' lines. The company's outlook is bright and adds materially to Massillon's many new business enterprises.

New Appliances

Fuse Tester—Rosette and Receptacle—Railway High-Speed Circuit-Breaker—Gasoline Dispenser—Fuel-Oil Burner

AN ILLUMINATED FUSE TESTER.

Unless some form of tester is available, which usually is a crude and home-made device, it is at the present time a common practice to replace with new fuses all of the fuses of a cutout box or panel in which one fuse is blown, waiting for some future opportunity to make a test to detect the blown fuse or fuses among the batch and to replace in stock those fuses which are still intact. This method, of course, consumes much time unnecessarily; moreover, it requires a stock of fuses fully double that which would answer the purpose where tests for operative fuses are made at the cutout box; furthermore, it interferes needlessly with many lighting circuits and thereby causes annoyance.

A simple appliance designed to do away with this waste of time and money in discovering the blown fuses has been developed and is being marketed by R. S. Blake, 238 South La Salle Street, Chicago, Ill. This device consists essentially of means for testing the fuses in place with absolute safety and with the back of the fuse illuminated by the light from a dry cell flashlamp. The testing device is held in one hand, the light flashed on and the necessary contacts are made by means of two contact points shown in the accompanying illustration; one of these is a stiff,

Blake Illuminated Fuse Tester for Making Tests Safely and Quickly.

heavy rubber-insulated wire, and the other is a rubber-insulated flexible wire. The result of the test is immediately apparent by the lighting or remaining dark of the two test lamps arranged in series on the device.

At present the electrician who has equipped himself with a couple of sockets in series needs a helper to hold a lamp, where the cutout is in a dark spot, as is frequently the case in many industrial plants, theaters, hotels, on shipboard, in mines, etc. With the above described combination of tester and flashlamp, it is entirely possible for even one-armed men to make the proper tests.

The sockets in the Blake fuse tester are standard Edison base sockets and any standard lamp may be used in them. Any voltage up to 500 may be tested. In making tests for 500 volts it is necessary to use two 220-volt lamps. In making tests on 110/220-volt circuits, two 110-volt lamps are used.

This device is practically indestructible and can be obtained with or without the flashlight, thus if the electrician is already provided with a flashlamp he needs only to purchase the tester proper.

INTERCHANGEABLE CONNECTING BLOCK, ROSETTE AND RECEPTACLE.

The Bryant Electric Company, Bridgeport, Conn., has placed on the market a connecting block of unique

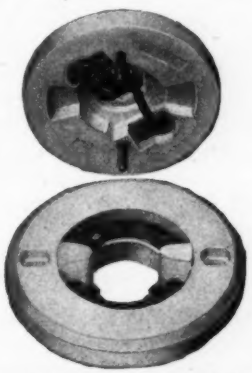


Fig. 1.—View of Under Side of Cap and Top of Base of Connecting Block and Rosette.

design. As furnished, this block consists of two pieces of porcelain fastened together from the exterior by means of two screws, which are retained by fiber washers in their holes in the top piece, even when the two parts of the block are separated. These screws also form the current-carrying contacts between the top

Fig. 2.—Top View of Connecting Block Assembled Complete.

and base. The base of the block, as will be noted in Fig. 1, has a substantial recess for the two firmly fixed binding plates, each of which has four binding screws, to permit of ready connection of wires for additional circuits as may be needed.

Thus it is unnecessary to remove the fitting or to awkwardly splice and solder the wires as would ordi-

narily be required, because there is ample room for handling the wires through the round opening in the base.

As will be noted in Fig 2, there is a small film or "knockout" of porcelain in the center of the cap. A light blow will serve to knock this out, transforming the "block" into a rosette. Wires can be passed through this opening and fastened at the binding screws, as shown in the upper view of Fig. 1, so that a drop light or switch fixture can be attached.

Another interchangeable feature of this block is that to this same style base a porcelain lamp receptacle

Fig. 3.—Porcelain Receptacle Mounted on Same Interchangeable Base.

(as shown in Fig. 3) can be attached. The heavy lugs shown in the base fit into the recesses molded into both the top piece of the block or rosette and the lamp receptacle base and insure the correct relative position of the parts so that the fastening screws (which also serve as current connections) can be easily and properly fastened.

These devices, designated as list No. 566 for the rosette-connecting block and No. 4122 for the receptacle, are designed for attachment to standard 3¼-inch outlet boxes and to No. 700 Adaptiboxes. They are approved devices.

NEW HIGH-SPEED CIRCUIT-BREAKER FOR HEAVY DIRECT-CURRENT SERVICE.

Unique Apparatus Installed in Substations on the Chicago, Milwaukee & St. Paul Railway Electrification.

High-speed circuit-breakers involving unusual characteritsics have been developed and placed in operation

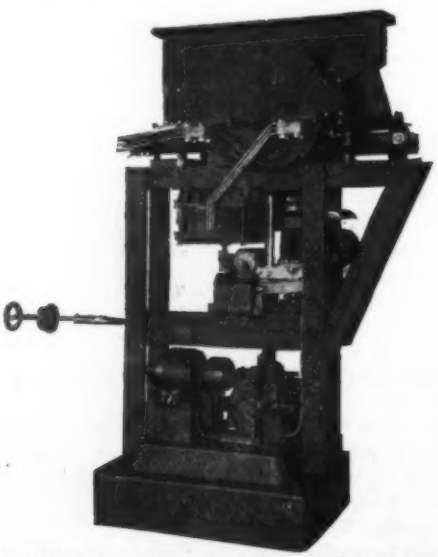


Fig. 1.—High-Speed Circuit-Breaker With Magnetic Blowout for the Chicago, Milwaukee & St. Paul Railway. Type MW, 3000 Amperes, 3600 Volts.

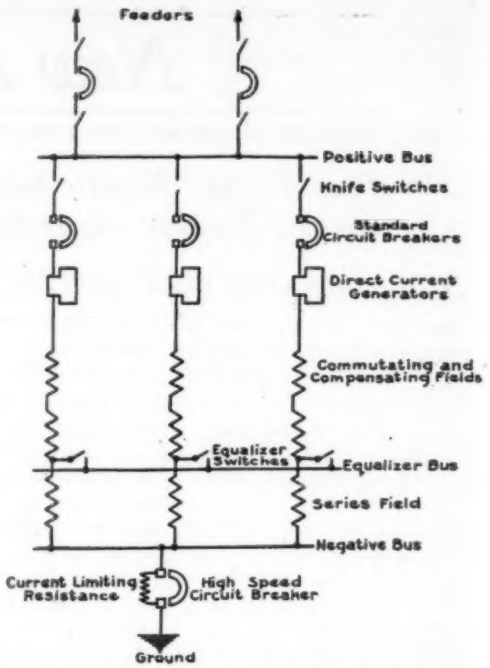


Fig. 2.—One-Line Diagram of Direct-Current Connections for Substations Equipped With Three Motor-Generator Sets Protected by High-Speed Circuit-Breaker Connected Across Limiting Resistance.

by the General Electric Company to protect the generating apparatus in the Chicago, Milwaukee & St. Paul Railway's substations from flashovers resulting from short-circuits near the stations. It is the function of this apparatus to operate with sufficient speed to check the rise in current caused by a short-circuit before damage can be done to the converting equipment. In order to meet this requirement, it is necessary that the rise in current be checked within a few thousandths of a second and the circuit-breaker described below meets these conditions in every respect.

The rate of acceleration on the main and secondary contacts is approximately 8000 feet per second and they are released in a time as short as 0.003 second or less from the beginning of the short-circuit. The time

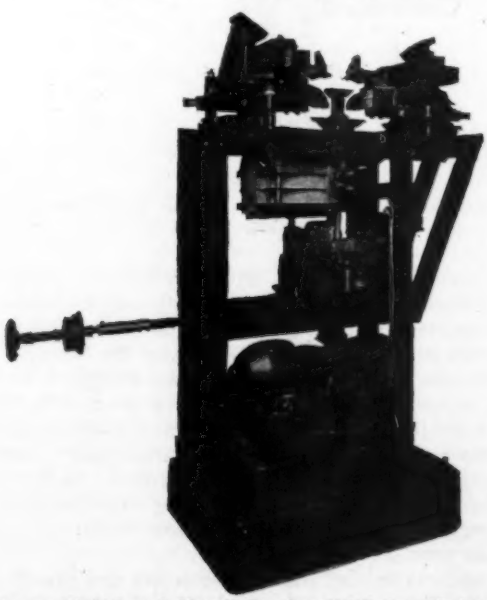


Fig. 3.—High-Speed Circuit-Breaker With Arc Chute Removed.

from the beginning of the rise in currert caused by a short-circuit until the secondary contacts part, has shown by test to be of the order of 0.004 second. This compares with about 0.10 to 0.15 of a second, the speed of ordinary switchboard-type breakers. The designers have thus succeeded in building a breaker which will in effect foresee the rise in current caused by a short-circuit and insert sufficient resistance to limit this rise to a safe value.

It has been the practice on many railroads to install a certain amount of feeder as resistance between the substation and the tapping-in point, usually by carrying out the feeders to some distance from the station before tapping in. It was evident, therefore, that if apparatus could be developed to protect the generators from liability of flashover on severe, short-circuits, it would permit of the feeders being tapped directly to the trolley at the substation, thus eliminating the losses due to feeder resistance.

Preliminary calculations in connection with the electrification of the Chicago, Milwaukee & St. Paul Railway showed that quite an appreciable amount of power could be saved each year by the elimination of this extra feeder resistance. Work was therefore initiated on the development of an air circuit-breaker which would have such a high speed in opening that it could be used to insert resistance in the circuit soon enough to prevent the short-circuit current from reaching such a value as to cause the direct-current machinery to flashover. This design of breaker required a speed much faster than anything ever before attempted. Careful investigations demonstrated that the device must operate in a shorter time than is required for one commutator bar to pass from one brush to the next or less than one-half cycle for that particular machine.

One of these breakers is installed in each substation and connected into the negative return circuit between the ground and the negative bus. (See Fig. 2.) This location would give the maximum protection, since the return circuit must pass through the limiting resistance in case of a flashover from the positive to ground as all of the negative terminals, bus rigging, etc., are insulated for full generator voltage. To insure complete protection, the high-speed breaker is so interlocked with the regular switchboard type of air circuit-breaker that the high-speed breaker must always be closed before the switchboard breakers.

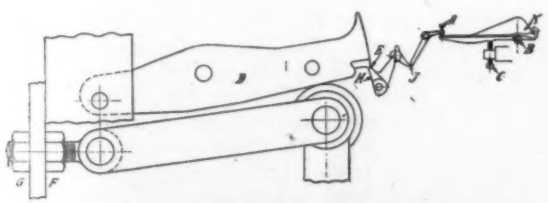


Fig. 4.—Diagram of Levers for Tripping and Resetting the Type MW Circuit-Breaker.

The 14 3000volt direct-current substations on this railway system are equipped with this new type of breaker and the first units installed have been in operation since early in 1917 with very satisfactory results. All substation feeders are tapped to the overhead trolley system directly at the substation, eliminating the resistance losses occasioned by tapping at some distance away. Actual operation has demonstrated that it is entirely practicable to operate direct-current stations in this manner when protected by the high-speed circuit-breaker, even though the voltage of the system (3000 volts) is the highest direct-current voltage used in commercial railway work.

Description of the New Breaker.

This new high-speed circuit-breaker is of the single-pole, magnetic-blowout type rated 3600 volts, 3000 amperes, direct-current. The breaker and mechanism

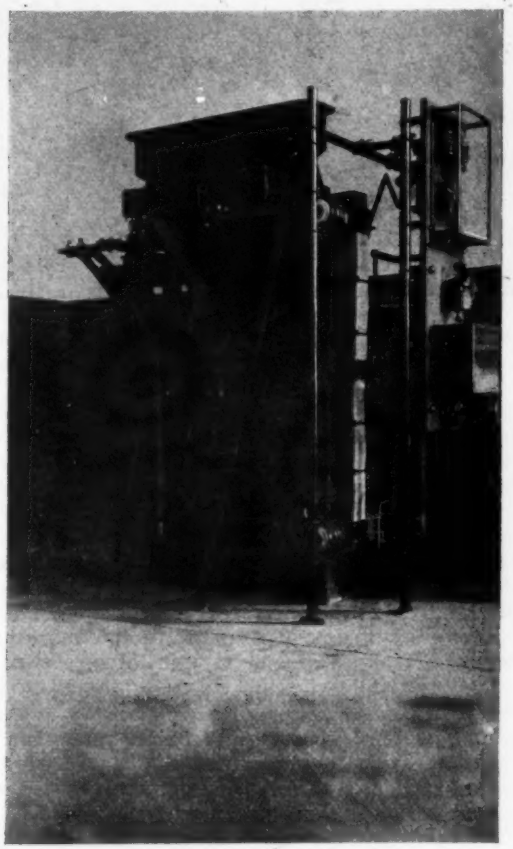


Fig. 5.—High-Speed Circuit-Breaker Installed in Janney Substation, Chicago, Milwaukee & St. Paul Railway.

for a self-contained unit are mounted on a structural-iron framework with cast-iron base. The base and framework are in turn mounted on an insulating base to insulate the circuit-breaker from the station floor. The operating mechanism is so arranged that the breaker can be closed either by hand at the breaker, or by a motor controlled from the station switchboard. The closing of the breaker by means of the motor is accomplished by a cam mechanism operated through gears. When closed by hand, a ratchet mechanism is used.

The main contacts are of the well-known laminated-brush type, the brushes forming the stationary contacts. The movable contact is a solid copper forging which is made as light as possible in order to reduce to a minimum the mass to be moved in operation. Secondary contacts are located above the main contacts and are of very ingenious design to insure their breaking after the main contacts in order to prevent any possibility of burning the current-carrying parts of the main contact. All of the contacts are located in a blowout chute of insulating material designed to withstand the burning incident to the arc. The blowout magnet is of laminated iron of large section. The blowout coils and trip coils are connected in series so that

the blowout coils are excited at all times, as the usual arrangement of shunt blowout coils was found to give insufficient speed of blowout. The main and secondary contacts are carried on a lever and this lever is actuated on the regular switchboard air circuit-breakers usually installed.

A reference to the oscillograph record shown in Fig. 6 gives a good idea of the remarkably high oper-

Fig. 6.—Oscillograph Record of Short-Circuit on 2000-KW., 3000-Volt Motor-Generator Set Checked by High-Speed Circuit-Breaker and Standard 3000-Volt Switchboard-Type Circuit-Breaker.

by a nest of compression springs which exert a force of about 8000 pounds when the breaker is adjusted for operation. It was found that this pressure was required to give the rapid acceleration necessitated by the high-speed conditions under which this circuit-breaker is required to operate.

The tripping is accomplished through a train of latches and levers actuated by a solenoid, the magnet frame and core of which are specially laminated to obtain a quick magnetic response to the short-circuit current. The object in using a series of several latches is to allow the mechanism to move the main latch through a distance of ⅛ inch or more by means of a solenoid. This solenoid, in order to act in the time required, is able to move only a distance of about 0.001 of an inch and can exert a force of only about 200 pounds, while the main latch is subject to a pressure of about 4000 pounds transmitted through a lever from the compression spring above referred to.

The calibration in order to take care of the varying number of units in the several stations, is obtained by means of an adjustable tension spring directly opposing the pull of the solenoid. Referring to Fig. 4, the actual tripping takes place at *J*. The levers *A* and *K* are to multiply the movement of the solenoid, which delivers its force at *B* so as to obtain a movement large enough to be entirely definite. The latches from *E* to *J* are special forms of levers which reduce the great pressure at *E* to a value which can be handled by a small bearing surface at *J*.

Upon the opening of the breaker contacts, the resistance becomes increasingly effective due to the resistance of the arc as the breaker completes its operation and after the lapse of about 0.008 of a second or less from the beginning of the short-circuit (see Fig. 6) the resistance has increased to such a value that no further rise of current can take place.

This method of protection has given such satisfactory results that high-speed circuit-breakers have been adopted by the General Electric Company as standard on all 3000-volt direct-current generating apparatus for steam-railroad electrification. Actual service has demonstrated that the high-speed breaker will protect the generating apparatus from all short-circuits experienced, and that it not only prevents damage to the brush rigging, commutator, etc., but relieves the duty ating speed of this circuit-breaker and the resulting protection against damage to equipment. It may also be noted that this oscillogram shows the maximum current rise of less than ten times normal which is quickly reduced to well within the commutating capacity of the machine. With this method of protection, none of the effects of the direct-current short-circuits are transmitted through the set to the alternating-current side, thereby preventing such disturbances from affecting in any way the alternating-current supply system.

The breakers were installed by the electrification department of the railway company under the direction of R. Beeuwkes, electrical engineer.

MOTOR-DRIVEN VISIBLE-MEASURE GASOLINE DISPENSER.

The incidental losses in the vending of gasoline are claimed to be eliminated by the use of a visible-measure gasoline dispenser. In a device of this kind known as the Brady dispenser, the pump is driven by a Westinghouse ¼-hp. motor, entirely enclosed in the base in accordance with the rules of the National Board of Fire Underwriters. The Brady dispenser visibly delivers a full gallon for every gallon ordered. When the wagon delivers gasoline to the garage, the tank gauge shows accurately the full quantity obtained. Every gallon drawn from the tank into the dispenser is shown on the tank register, which can be checked with the tank gauge. Thus, both the public and the garage owner are protected from loss. Furthermore, the oil companies are enabled to make more rapid deliveries than by measuring cans from wagon to garage tank where the Brady dispenser is installed.

SUCCESSFUL BURNER FOR FUEL OIL.

In order to prevent a recurrence of the fuel conditions of the past winter, much study is being given to the fuel situation. One of the suggested means for relief is the more extensive use of fuel oil, with its simplicity in handling, convenience, efficiency, particularly in those sections of the country where it can be easily and cheaply obtained.

The types of burners available for general use have greatly restricted the use of oil. To be successful.

such a device must be simple. Complicated machinery, driving pumps, air blowers and gear boxes form a complex problem, with high initial cost and heavy expense for upkeep. The burner should require few, if any, adjustments after installation, and should operate over long periods of time without attention. When properly installed a successful burner carries a very low fire hazard.

To burn fuel oil, it must be perfectly atomized, and at the same time sufficient air must be introduced to get thorough combustion. Several methods have been used to accomplish this. Steam and air atomization, while successful, are not entirely satisfactory for a number of reasons, chief of which is the waste of oil, which cannot be countenanced, particularly under present conditions. Air atomization requires too much complicated machinery to obtain the desired results. Steam is not always available and is only feasible for high-pressure work. Therefore, in order to make the burning of fuel oil both popular and profitable, the need has been for a mechanical atomizing burner with high efficiency, low upkeep and small initial cost.

W. S. Ray, of the W. S. Ray Manufacturing Company, 220 Market Street, San Francisco, Cal., has devised a method of atomizing oil in a horizontal open cup, driven at 3450 revolutions per minute, and then forcing air at high velocity around the cup and in a direction away from the cup. In this method he not only introduces sufficient air for proper compression but also enough to direct the fire into the firebox. Naturally, the air leaving the blower would be turning in the same direction as the atomizer, causing the fire to be unsteady, and having a tendency to throw oil on all sides of the firebox, but this the inventor overcomes by inserting guide vanes in a nozzle surrounding the atomizer, which direct the air from a revolving motion to a straight path.

This method has been found to give perfect combustion to the oil, and the inventor has developed a burner to utilize it with as little complication as possible. It is constructed of the best material, and all parts are easily interchanged and made of standard design.

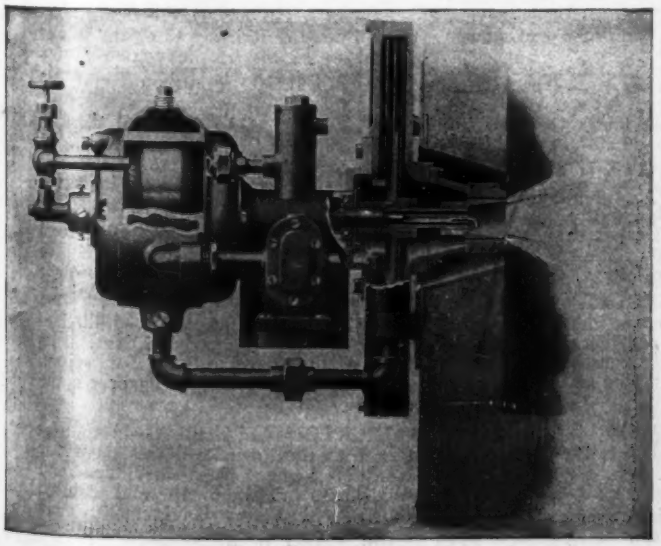
The Ray oil burner has been standardized with a Westinghouse totally inclosed motor. The hollow shaft of this motor has been extended to permit the worm gear to be fastened to the center of the shaft, and the blower and atomizer are attached to the end opposite the motor. This permits the centering of the bearing on the shaft. A Hess-Bright ball bearing is used at each side of the worm gear. This worm gear is incased in a housing which is constructed with an oil well at the base. This gives the two bearings a splash feed which is positive and removes the danger of either underoiling or of overoiling.

The totally inclosed motor jacket is specially cast with a hollow frame so as to completely incase the motor and allow the fuel oil to continually pass around the motor. This lengthens the life of the motor by keeping it cool at all times, and at the same time warms the oil somewhat before it is introduced for combustion. This also permits the use of the burner in a boiler room with a temperature so high that an ordinary open motor would overheat and burn out.

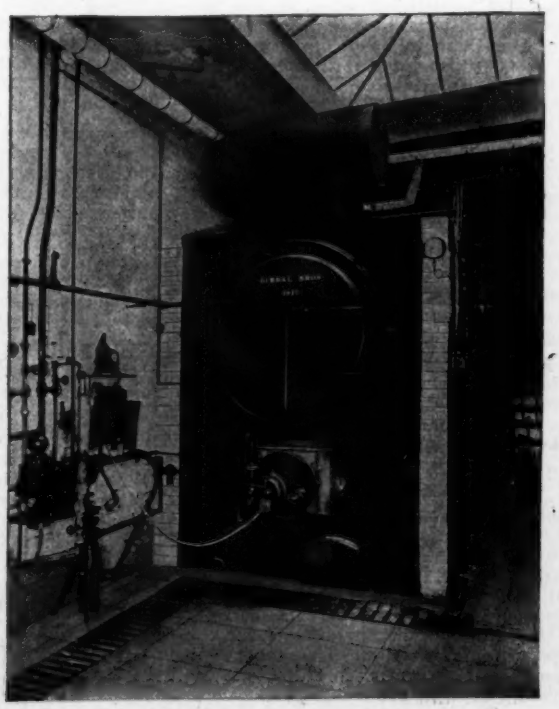
With the exception of domestic stoves, fuel oil as low as 14 degrees gravity can be burned successfully without smoke, soot or dirt, in all types of fireboxes, where high heat is needed. In California, with coal at $8 per ton, the fuel oil at $1.50 per barrel of 42 gallons, a saving of approximately 50 per cent over coal may be obtained with this burner, on the basis that coal has 14,000 B. t. u. per pound, as against oil at 18,500 B. t. u. per pound, and assuming that the coal is perfectly fired. Usually at least 25 per cent of the heat units are not obtained from the coal on account of imperfect firing, which invariably causes incomplete combustion.

In addition to this saving in the cost of fuel, there is an additional saving in the cost of attendance. To burn coal requires attendants constantly on the job 24 hours per day, whereas one man can supervise a large number of oil burners. This feature is well worth consideration, not only from a monetary standpoint, but also from the standpoint of the labor supply, which has been greatly depleted by war conditions.

The Ray oil burner is very flexible in its application and can be used in anything from a hot-air furnace in a private residence up to a 500-hp. steam boiler installation.



Sectional View of Ray Oil Burner.



Installation With 150-H.P. Boiler in a Candy Factory.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

FARMINGTON, ME. — Franklin Power Company is having plans prepared for a hydroelectric plant.

RUTLAND, VA. — The Rutland Railway, Light & Power Company has been granted permission by the Public Service Commission to increase its rates for gas and electric service, effective August 1.

AMHERST, MASS.—Contract has been awarded by the Massachusetts Agricultural College for the construction of the proposed new turbine plant and coal handling works at the institution. The structure will cost $56,200. Allen Brothers, Amherst, are the contractors.

DEERFIELD, MASS.—Boston & Maine Railroad Company has awarded a contract to the H. Wales Lines Company, 134 State street, Meriden, Conn., for the construction of a one-story local engine plant, to cost about $75,000.

CANTON, N. Y.—Heuvelton Heat, Light & Power Company has filed notice with the Public Service Commission of the dissolution of the company.

BUFFALO, N. Y.—Contract has been awarded by the General Electric Company to Huntley & Derdenger, Buffalo, for the construction of the proposed new three-story plant with power house, to cost about $200,000.

BUFFALO, N. Y.—Pierce-Arrow Motor Company, 1695 Elmwood avenue, has awarded a contract for the construction of a one-story power house addition to its plant, about 33 x 43 feet. It is said that the plant, with equipment, is estimated to cost over $200,000. Stone & Webster, Boston, Mass., are the contractors.

NEW YORK, N. Y.—Washburne Wire Company, One Hundred and Eighteenth St. and the Harlem River is rushing to completion the erection of its new plant at 528-58 East One Hundred and Eighteenth street. The structure, which will replace the plant recently destroyed by fire, is now practically completed, the estimated cost being placed at approximately $350,000.

NEW YORK, N. Y.—Sundh Electric Company, 52 East Forty-second street, has filed notice of an increase in its capital from $120,000 to $170,000, to provide for expansion.

DOVER, N. J.— New Jersey Power & Light Company has recently completed the construction of the new 11,000-volt transmission line to the plant of the Atlas Powder Company, and operations will be inaugurated at an early date. The company has just contracted with the Wharton Steel Company for additional power for the operation of a new 350-horsepower compressor recently installed at the Scrub Oak iron ore mines of the company. The new compressor, which is run by a synchronous motor of 2,300 volts capacity, will be operated on a twenty-four hour per day schedule, seven days per week.

JERSEY CITY, N. J.—The Board of City Commissioners has made announcement that plans are now being perfected for reductions in the electric street-lighting to aid in the conservation of fuel in compliance with the recent orders of the Fuel Administration. The "white way" lighting systems on Grove street, Monticello avenue, upper and lower Newark avenues, and Jackson avenue will also be reduced.

NEWARK, N. J.—Maas & Waldstein Company, Avenue R, has had plans prepared for the construction of a new addition to its power building to cost about $9,000. The company has taken out a building permit for the structure.

TOMS RIVER, N. J.—The Board of Public Utility Commissioners has granted approval to the application of the Toms River Electric Company to increase its rates for domestic and commercial power five cents per kilowatt hour, this increase to be a war surcharge only.

COATESVILLE, PA.—Chester Valley Electric Company has made application to the Public Service Commission for permission to take over the plant and properties of the Downington Electric Company.

CRANBERRY, PA.—Cranberry Creek Coal Company has commenced the construction of two new pumping plants at its Cranberry mines to house two of the largest electric pumping units in use in the Lehigh coal field.

MARYSVILLE, PA.—Borough Council is negotiating with the Juniata Public Service Company for supplying service for municipal light and power purposes.

PHILADELPHIA, PA.—The United States Government, Bureau of Yards & Docks, is having plans prepared for the construction of a new battery building at the local navy yards.

PITTSBURGH, PA.—Notice has been filed with the Public Service Commission by the Beaver County Light Company of a bond issue for $96,500 to provide for expansion.

SPARROWS POINT, MD.—Bethlehem Steel Company has had plans prepared for the construction of a new one-story concrete and steel power plant at its local shipbuilding works, for operation.

MOOREFIELD, W. VA.—Bonds have been voted for a municipal lighting system.

WYATT, W. VA.—In connection with extensive improvements at the Wyatt mines of the Consolidated Coal Company, the company is planning for the construction of a large electric power plant for works operation.

GASTONIA, N. C.—Parksdale Mills have had plans prepared for the installation of the necessary electrical equipment for the operation of a new plant to be erected to provide for increased capacity.

LINCOLNTON, N. C.—Boger & Crawford Spinning Mills Company is planning for the installation of the necessary electrical equipment in the proposed plant to be erected, about 104 x 184 feet. Roger C. Boger is president.

ROARING RIVER, N. C.—Blue Ridge Mill Company will develop a hydroelectric plant to supply power for grist mills.

THOMASVILLE, N. C.—In connection with the proposed construction of a new plant by the Ragan Knitting Company, to cost approximately $25,000, the company will install electric equipment for operation.

ANDERSON, S. C.—Orr Mills will construct an electric light, power and water works, in connection with its mills.

COLUMBIA, S. C.—In connection with the construction of a new addition to the plant of the F. T. Parker Company, electrical equipment for operation will be installed.

GREENVILLE, S. C.—Okeh Manufacturing Company has been organized to build a yarn mill. The specifications include 300 spindles operated with electric power drive. Address F. H. Cunningham, president.

HONEA PATH, S. C.—Chiquola Mills will construct an electric light, power and water system in connection with mills.

SPARTANBURG, S. C.—South Carolina Power & Railway Company is expected to extend its lines to Whitney and Converse. F. H. Knox, vice-president.

ATLANTA, GA.—Warford Shoals Light & Power Company is planning to issue bonds for $50,000, to be used, it is said, for extensions and improvements in its plant, system, etc.

CORNELIA, GA.—The Railroad Commission has granted authority to the Wofford Shoals Light & Power Company to issue $50,000 in bonds.

MILLEDGEVILLE, GA.—Milledgeville Telephone Company will extend its lines to the Georgia State Sanitarium. Address J. T. King, manager of the company.

JACKSONVILLE, FLA.—In connection with the townsite development for workers engaged in shipbuilding and war plants in Jacksonville and vicinity, the United States Government, War Department, has awarded a contract for the installation of a new electric-light-

ing system. W. P. Richardson, Jacksonville, is the contractor.

MONTICELLO, FLA.—The city is planning for a bond issue for $17,500, to provide for the construction of a municipal electric light plant.

NORTH CENTRAL STATES.

MARSHALLVILLE, OHIO.—Bonds to the amount of $1,400 have been voted to improve the municipal light plant. Address F. E. Kieffer.

NELSONVILLE, OHIO.—$2,500 in bonds has been voted to improve the village light plant.

ANDERSON, IND.—Remy Electric Company will erect a four-story factory.

COLUMBIA CITY, IND.—Preliminary plans for the abandonment of the municipal lighting plant, including the $17,000 turbine engine, have been started by the City Council. The recent investigations of the Council show that power can be purchased cheaper than it can be generated and the city will dispose of its plant, including the turbine engine.

FORT WAYNE, IND.—The local plant of the General Electric Company has been designated as an auxiliary plant of the Emergency Fleet Corporation, according to announcements recently made. The Fort Wayne plant employs 3600 persons.

FRANKFORT, IND.—The municipal electric lighting plant has petitioned the Public Service Commission for authority to issue $50,000 in bonds for improvements. Address manager.

INDIANAPOLIS, IND.—The Indiana Fuel Administration has issued an order limiting all industrial plants in the state to one month's supply of coal.

PLYMOUTH, IND.—Plymouth Electric Light & Power Company has filed a petition with the Indiana Public Service Commission to issue $20,000 in preferred stock.

CHICAGO, ILL.—The extensions under consideration by the Chicago Surface Lines include the completion of the Hegewisch street line, a distance of one and a half miles south from One Hundred and Twenty-third street and other additions in Hammond and East Chicago.

GRAND RAPIDS, MICH.—Ottawa Merchants' Association has petitioned the City Council to have the electric wires placed underground. Address city clerk.

SAULT STE. MARIE, MICH.—Carrol H. Shaw, of the War Industries Board, has filed a statement urging the installation of electric pumps as a coal conservation measure. It is estimated that the cost of installing these pumps will be $35,000. It is proposed to issue $50,000 in bonds to be used for improving the water works. Address city clerk.

BRODHEAD, WIS.—E. Guelson, superintendent of the water and light commission will purchase material for building a hydroelectric plant. The Power Engineering Company, 512 Corn Exchange building, Minneapolis, has prepared estimates.

DENNISON, MINN.—A franchise has been granted to the Gunderson Milling Company to furnish light to Dennison and Norstrand.

DATES AHEAD.

Association of Iron and Steel Electrical Engineers. Annual convention, Southern Hotel, Baltimore, Md., September 9-14. Secretary, John F. Kelly, McKeesport, Pa.

Northwest Electric Light and Power Association; affiliated with N. E. L. A. Annual convention, September 11, 1918. Secretary, George L. Myers, Pacific Fower & Light Company, Portland, Ore.

Michigan Section, N. E. L. A. Annual convention, Pantlind Hotel, Grand Rapids, Mich., September 17 and 18. Secretary-treasurer, Herbert Silvester, Monroe, Mich.

International Association of Municipal electricians. Annual convention, Atlanta, Ga., September 24-27. Secretary, Clarence R. George, Houston, Tex.

New England Section of the National Electric Light Association. Annual meeting, Hotel Kimball, Springfield, Mass., September 27 and 28. Secretary, Miss O. A. Bursiel, Boston, Mass.

American Electrochemical Society. Fall meeting, Princeton, N. J., September 29 to October 1. Secretary, Prof. J. W. Richards, Lehigh University, Bethlehem, Pa.

American Electric Railway Association. Annual meeting, Atlantic City, N. J., October 8 and 9. Secretary, E. B. Burritt, 8 West 40th street, New York City.

Illuminating Engineering Society. Annual convention, New York City, October 10. General secretary, Clarence L. Law, Irving place and 15th street, New York, N. Y.

Jovian Order. Annual convention, Dallas, Texas, October 24-25-26. Mercury, Ell C. Bennett, 1415 Syndicate Trust building, St. Louis, Mo.

Kansas Public Service Association. Annual meeting, Kansas City, Kans., October 17-19. Secretary-treasurer, W. W. Austin, Cottonwood Falls,

ST. CLOUD, MINN.—Great Northern Flour Milling Company will receive bids on material for equipping its flour mill with electricity.

GREENE, IOWA.—Power Engineering Company, 503 Corn Exchange building, Minneapolis, is preparing plans to enlarge the power house of the Greene Electric Light & Power Company.

INDEPENDENCE, IOWA. — Fayette Utilities Company, of Oelwein, has petitioned the Council for a franchise to furnish electric light.

BEVIER, MO.—This city is considering installing electric generating plant, it is reported.

HARRISONVILLE, MO.—The two propositions made by the Green Light & Power Company of Pleasant Hill, Mo., to the citizens of Harrisonville which embody either the leasing or purchase of the Harrsionville Municipal Electric Light Plant, are undoubtedly receiving more earnest attention on the part of the citizens than any of the previous proposals made by the Green Company.

HOLDEN, MO.—The city has contracted for a thirty kw. generator which will be shipped from Kansas City at an early date. The Green Light & Power Company, Pleasant Hill, has submitted a sealed bid for the purchase of the plant and rates for lighting the town, but it was submitted on condition that it would not be opened until all the other proposals had been submitted likewise.

HOLDEN, MO.—Holden Electric Light Company is having plans prepared for rebuilding electric power plant. Archer & Stevens, engineers, 609 New England building, Kansas City, Mo.

SPRINGFIELD, MO.—Plans are being prepared for improving the plant of the Springfield Gas & Electric Company. Address manager.

ST. LOUIS, MO.—The installation of street car service by the city of St. Louis over the Free Bridge between St. Louis and East St. Louis will mean the installation of a transformer to charge the alternating current into direct current. The installation will cost $15,000.

AUGUSTA, KANS. — Municipally owned public utilities, electric light plant, gas plant and waterworks, representing an investment of $282,000, directed by a city manager, netted the city of Augusta a profit of $44,441 in the year ending July 1, 1918. The city will soon build a $50,000 light plant and City Manager Graham estimated it will pay for itself in two years.

KINGMAN, KANS.—The increasing demand for current for motor power has made it necessary for the city commissioners to consider another change. The tentative plan is to take out one of the units and replace it with a much larger one, capable of carrying the heavy day load.

PALMER, NEB.—$3000 will be expended for improving the water and light plant. Address city clerk.

STERLING, NEB.—The people of Sterling have been assured that they will not long be without an electric lighting plant. The plant has been completely destroyed by fire. W. W. Martz, local manager of the Nebraska Electric Lighting Company, the concern which owned the plant in Sterling, informs his patrons that a new plant is to be put in at once and he hopes to have it equipped and in running order within a few weeks.

PEMBINA, N. DAK.—Pembina Light & Power Company will extend its transmission line. Address manager.

SOUTH CENTRAL STATES.

INVERNESS, MISS.—The city has had plans prepared for alterations and improvements in the municipal electric lighting plant and water system. X. A. Kramer, Magnolia, is consulting engineer.

ASHDOWN, ARK.—Commonwealth Public Service Company is contemplating the installation of an engine and generator in the electric light plant.

LAKE CHARLES, LA.—Plans are being made by the Louisiana Western Railroad Company for the construction of a roundhouse and terminal facilities in Lake Charles, to cost approximately $132,000.

BRACKETTVILLE, TEX. — Fort Clark is again to share in the general improvements to be made in the army camps and has received an appropriation for the improvements. Work is to begin at once on the electric light system.

JUAREZ, TEX.—Tentative plans are being made by business men of the city for an electric light plant in Juarez. According to the plans, it is the intention to erect a large power plant and bring machinery from an abandoned plant near Parral.

LUBBOCK, TEX.—A municipal light and power plant will be constructed to cost $35,000. Address mayor.

RANGER, TEX.—The Chamber of Commerce is promoting the organization of a local company to construct an electric light and power plant.

WESTERN STATES.

POPLAR, MONT.—Poplar Power Company contemplates the installation of additional electric equipment.

SEATTLE, WASH.—Westinghouse Electric & Manufacturing Company, has been awarded contract by the city of Seattle for four 1000 kva. transformers and the General Electric Company has been given a contract to duplicate this order. These transformers are to be used mostly in the shipyards where the city is furnishing a large amount of current.

SEATTLE, WASH.—The city council of Seattle has unanimously determined to ask the next legislature for the right to sell power outside the corporate limits in territory contiguous to transmission lines. The city now has developed 29,500 kilowatts or about 40,000 horsepower and is seeking to develop an additional 35,000-kilowatt unit.

SPOKANE, WASH. — Washington Power Company has been called upon to expend $750,000 on its Long Lake plant to meet the demands of the Chicago, Milwaukee & St. Paul Railway for power. Address D. L. Huntington, president of the company.

PORTLAND, ORE.—Liberty Foundry, Inc., recently incorporated, is planning for the installation of an electric welding department in the plant of the Lister Sash Weight Company recently acquired.

PORTLAND, ORE. — Northwestern Electric Company, Pittock building, has secured a permit to erect one-story fuel bunkers at a cost of $32,000 at the foot of Harrison street, for which plans were prepared by Charles C. Moore & Company, engineers.

PORTLAND, ORE.—Parker & Banfield, local contractors were low bidders for erection of the transformer house at the Vancouver end of the interstate bridge over the Columbia river, at $5260.

WILLAMETTE, ORE.—Crown-Willamette Paper Company is said to be planning for the construction of a large dam and power plant capable of developing 2000 horsepower for the operation of the proposed mill to be erected. The work will be located on property recently acquired adjoining the Young's River falls.

FRESNO, CAL.—San Joaquin Light & Power Company is planning to furnish about 40,000 kilowatts of electric power to the Fresno Canal & Land Company to be used for the operation of machinery for irrigation purposes.

LOS ANGELES, CAL.—The board of public works has recently awarded a contract for the construction of an ornamental street-lighting system on Broadway, from California to Tenth streets, to cost about $69,000. The Keystone Iron Works, Los Angeles, is the contractor.

LOS ANGELES, CAL.—Standard Oil Company has awarded a contract for the construction of a one-story concrete boiler plant, about 52x52 feet, to be located near Turning Basin, Smith Island, San Pedro. Earl F. Low, Wilcox building, Los Angeles, is the contractor.

ONTARIO, CAL.—San Antonio Water Company is arranging for the construction of its proposed new power house in the San Antonio canyon. Glenn D. Smith is manager.

ORANGE, CAL.—The city council is having plans prepared for the immediate installation of an ornamental street lighting system.

PASADENA, CAL.—The city is planning to lease the distributing system of the Edison division of the Southern California Power Company for a period of two years, and the proposed contract has been approved by the city commission.

REDDING, CAL.—A bond issue for $40,000 has been authorized by the city to provide for the installation of a municipal lighting system.

RICHMOND, CAL.—The Richmond division of the Western States Gas & Electric Company has secured an additional 50 horsepower in motors to its electric energy load for the Los Angeles Pressed Brick Company.

SACRAMENTO, CAL.—Union Iron Works will construct at Hunter's Point a third great shipbuilding plant at a cost of approximately $2,000,000.

SAN BERNARDINO, CAL.—The city commission is considering plans for the conversion of the Antil steam pumping plant into an electrically-operated one.

SAN DIEGO, CAL.—Consolidated Gas & Electric Company has recently made application to the State Railroad Commission for permission to lay cables across the bay from San Diego to Coronado for the purpose of supplying electric service for government operations now under way at the latter location.

SAN FRANCISCO, CAL.—Southern Sierras Power Company is having plans prepared for the construction of a transmission line from Russ Creek, Mono county, to Bishop Creek, Inyo county, a distance of about 63 miles. The work is estimated to cost about $270,000.

SAN FRANCISCO, CAL.—Pacific Telephone & Telegraph Company has recently awarded a contract for the construction of a six-story building to cost in the neighborhood of $200,000. J. M. Dougan, San Francisco, is the contractor.

SANTA ANA, CAL.—Kaufman & Sons, manufacturers of spot lamps, are planning for the immediate erection of a new plant to be located at 1625 East First street, to provide for increased capacity. Plans for the structure have been filed.

SANTA BARBARA, CAL.—The city council has authorized a bond issue for $500,000 to provide for the construction of the proposed Gibralter dam.

VALLEJO, CAL.—Vallejo Electric Light & Power Company is planning to make extensive improvements and additions to its power plant at the foot of Kentucky street, including the installation of new and larger transformers and a quantity of electrical equipment. Plans are also under consideration for the construction of a second pole line from South Vallejo to the Kentucky street plant.

PROPOSALS

MACHINERY FOR LIGHT PLANT.—Bids will be received at Marshallville, Ohio, on September 7 for repairing and furnishing machinery for the municipal electric light system. Address F. E. Kieffer, village clerk.

ENGINE AND GENERATOR.—Bids will be received August 22 for furnishing an engine and generator for the central heating and light plant of the Miami University at Oxford, Ohio. Specifications have been prepared by Engineer Walter G. Franz, consulting engineer. Address Walter Tobey, chairman of the building committee.

INCORPORATIONS

NEW YORK, N. Y.—Kinetic Engineering Co. Capital, $50,000. To engage in the manufacture of electrical supplies. Incorporators: A. Mandels, S. L. Baron, and V. Campbell, 152 West One Hundred and Twenty-ninth street.

NEW YORK, N. Y.—U. S. Devices Corporation. Capital, $5,000. To manufacture electrical specialties. Incorporators: J. H. Betts, A. T. Holbrook, and L. Hengerer, 320 Riverside drive.

NEW YORK, N. Y.—Radio Materials Corporation. Capital, $100,000. To manufacture wireless apparatus and equipment. Incorporators: E. J. Sampler, R. A. Adams, and A. E. Seelig, 352 West Thirteenth street.

ROCHESTER, N. Y. — Rochester Home Electric Company has incorporated with a capitalization of $25,000 to deal in electric lighting and power plants and accessories. The incorporators are P. E. Illman, J. M. Illman and H. Adsit Bulk.

CHESTERFIELD, S. C. — Teal Light & Power Company. Capital, $10,000. To operate a plant for the generation and distribution of electric energy. D. T. and E. Teal are the principal incorporators.

THOMPSON, GA. — Thompson Light & Water Company. Capital, $70,000. To operate a local electric power plant. Incorporators: R. L. Hardaway, B. F. Johnson, and G. W. Lokey.

BOSTIC, N. C.—Rutherford Telephone Company. Capital, $5,000. To construct and operate a local telephone system. Incorporators: E. and W. A. Thompson, and K. J. Carpenter.

BOERNE, TEX.—Boerne Light & Ice Company. Capital, $10,000. To operate a local electric light and ice manufacturing plant. Incorporators: J. J. North, Alfred Pfaendler, and L. H. Bowden.

HARTLAND, MICH. — Hartland Light & Power Company has been incorporated with a capital of $2,000.

SEATTLE, WASH. — Electric Gun Company has been incorporated for $250,000 by R. L. Christensen, F. A. Andrews and C. E. Wineberg and others with the object of carrying on a manufacturing business.

Trade Activities

Ajax Electric Specialty Incorporates—General Devices & Fittings Opens Pittsburgh Office—Special Catalogs Mailed

Merrill Manufacturing Company, 294 Washington street, Boston, Mass., a recently organized concern, has taken over the business of the New England Fuse Manufacturing Company, Boston, Mass. The new company maintains works at Whitman and Monponsett, Mass., and will manufacture Edison plug fuses, electrical porcelains, porcelain dies, etc. M. H. Merrill is president, and Frank Sanford, vice-president of this new company.

The Baker R & L Company, Cleveland, Ohio, recently published two booklets entitled "The Baker System of Industrial Transportation," the one dealing with the use of electric utility trucks and the other describing electric tractors for all industrial uses. Both the truck and tractors described are manufactured in four types, namely four wheel drive-four wheel steer, four wheel drive-two wheel steer, two wheel drive-four wheel steer and two wheel drive-two wheel steer, and their design is the work of engineers who have been building battery driven vehicles since the beginning of the industry. They are manufactured in the factories of the Baker R & L Company, which have been producing electric passenger and industrial vehicles of various types continuously since 1908. These booklets describe each and every part of these industrial machines and contains numerous illustrations and diagrams by way of explanation. Pamphlets describing other industrial machines will be furnished upon request to this company.

Ajax Electric Specialty Company, 1408 Morgan street, St. Louis, Mo., is the name of a new corporation which will engage in the manufacture of specialties and represent manufacturers of staple electrical merchandise and novelties. Ernst Alschuler, recently sales manager for the American Carbon & Battery Company, and for many years Chicago manager for the Interstate Electric Novelty Company is president of the company. The vice-president and treasurer of this new enterprise is James S. Cuming, who recently disposed of his interests in the Central Telephone & Electric Company, of which he was the organizer in 1898 and president since that time. Oscar Walters, secretary, has been in charge of the manufacturing interests of the Central Telephone & Electric Company for the last 12 years. The Ajax Electric Specialty Company invites correspondence from manufacturers of high grade lines, desiring exclusive representation for western territory, by concerns owning their own warehouses. Jobbers desiring lines that will interest their salesmen and give them leaders to interest dealers will find that the Ajax company has a very interesting proposition to offer.

George R. Cooley Electric Company, with offices and shop at 813 Western avenue, Seattle, Wash., is supplying and installing much equipment for the Pacific Construction & Engineering Company, a Seattle concern. This includes two generating plants for supplying direct current to cranes. These plants aggregate 300 horsepower in capacity. The company is also building a large number of switches for the auxiliary lighting plants that are required on all ships.

Trumbull Electric Manufacturing Company, Plainville, Conn., advises that it has permanently discontinued the manufacture of armored cable, armored cord and flexible steel conduit, formerly listed under its schedules "X" and "Y." This step has been taken so that the company may devote its entire energy to its other lines, including a large amount of Government business, direct and indirect, also its well known line of "Safety Service" externally operated knife switches.

General Devices & Fittings Company, Chicago, Ill., in order to meet the increasing demands for its engineering service, has opened a new district office in Pittsburgh. C. A. Bird, one of its best technical engineers, has been placed in charge and has established headquarters at 1303 Arrott building. Mr. Bird has done much research work in the line of high-tension phenomena, and prepared many papers on conductor calculations and allied engineering subjects. He was formerly one of the district engineers in the Cleveland office of the company, and while there, had charge of Pittsburgh district work.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has just issued the revised edition of Westinghouse Catalog 3-B, in which a number of new types of apparatus are listed, including the types AW and FW duplex instruments. These consist of any two of the standard types AW or FW instruments, respectively, contained in attractive dull black metal cases; the types EH and PH ammeters, which are hot-wire instruments suitable for operation on either direct-current or alternating-current circuits of any frequency; the type OA watthour meters for switchboard service, which are similaar to the well-known standard house-service type OA watthour meters, except that they are designed for switchboard service; the motor-operated type M graphic instruments; type CV voltage relays, which can be furnished to operate either on under-voltage or over-voltage, as ordered; the type CP reverse-phase relays to provide against phase reversals; type BT transfer relays, which operate with the excess current relays, such as the Westinghouse type CO and type CR, to directly energize the operating coil of the circuit-breaker from the current transformer, no separate operating circuit being required, and type CT temperature relays, which depend for their operation upon the temperature of the apparatus on the circuit as well as the amount of the overload. This catalogue listing instruments and relay in standard 8½x11-inch size, is a departure from the original edition of the same catalog, in that wherever possible each particular type of apparatus is listed on only one page—and where more than one page is required, the several pages necessary are confined to a description and listing of only the one particular type—so that it is very easy to find what one is looking for in this catalog.

Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has issued a four-page envelope folder (Publication 262 entitled "C-H Electric Laundry Irons." This folder illustrates and describes the special feature of C-H laundry irons, such as the steel clad connector plug, the patented sealed-in heating unit, etc. This unit is permanently sealed in a steel casing, which is electrically welded to the shoe or bottom plate. All heat developed by the unit goes directly into the ironing surface where needed. Two standard sizes are made, the 7½-pound iron for medium work and the 9-pound iron for heavy work. The folder is imprinted and furnished to dealers selling C-H irons and other heating appliances.

Wirt Company, Armat and Lena streets, Germantown, Philadelphia, Pa., has prepared a large stock of folders for distribution by local dealers, whose imprint can be placed thereon. These folders are gotten up in a very attractive manner and tell their own story in pictures. They feature the light-regulating properties of the Dim-a-lites which have five changes of light: full, low, dim, night-light, out. Four types of Dim-a-lites are now available, namely, the old and well known plug-socket device, which can be attached into any socket and the lamp in turn attached to it; two forms of Dim-a-lite sockets, one with and one without shade-holder attachment for wiring direct to the fixture; the portable Dim-a-lite socket arranged for use as a bed reading lamp or for similar purposes. The Dim-a-lite sockets, which were described and illustrated in the ELECTRICAL REVIEW several years ago, are meeting with rapidly increasing favor because they permit as convenient change of light intensity from any socket as may be obtained from the gas lamp, and therefore add to electric lighting this one desirable feature, which is the only one in which gas lighting has formerly possessed any advantage.

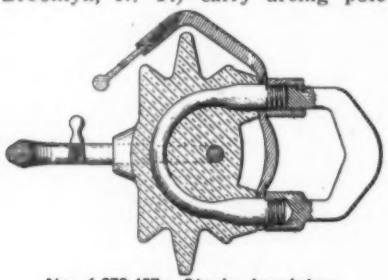
Recent Patents

Selected and Summarized by Albert Scheible, Patent Attorney, 79 West Monroe Street, Chicago, Illinois

A series of brief comments on some of the recently issued electrical patents which appear to be of particular interest to our readers, the number after each heading being that of the United States patent to which the summary relates. Any correspondence regarding such patent matters should be sent direct to Mr. Scheible at the above address.

Electric Water Heater (1,270,198).—An insulated resistance wire is inclosed in a metal sheath which is wound around a copper tube, after which a jacket of aluminum is cast around the tube and the sheathed wire. Patent assigned by Leon F. Parkhurst, of Schenectady, N. Y., to the General Electric Co.

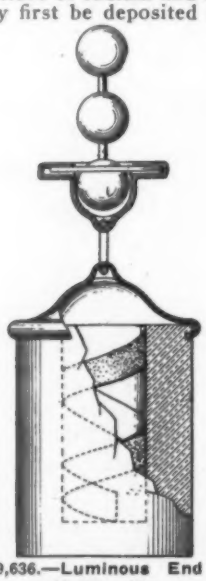
Strain Insulator (1,270,457).—The two strain loops of this insulator (patented by Louis Steinberger, of Brooklyn, N. Y.) carry arcing pole



No. 1,270,457.—Strain Insulator.

members which are adjustably mounted and one of which overhangs the body of the insulator.

Luminous Indicator (1,269,636).—This handle for pull chains consists of a thick glass tube with a closed bottom and having luminous material inside the tube. This material may be a mixture of radium and zinc sulfid and may first be deposited on a thin



No. 1,269,636.—Luminous End for Pull Chains, Etc.

strip of celluloid, which is then coiled spirally within the glass tube. The patent was assigned by Sigurd A. E. Norring and Victor C. Thorne to the Schlosinger Radium Co., of New York City.

Storage Battery (1,269,162).—The liquid electrolyte is stored in tubes of porous material within this battery cell of Walter A. Crowdus, of Chicago, Ill.

Electric Vibrator (1,270,342).—The core of this vibrator is resiliently supported by having some of its laminae bent and secured to the supporting members. Patented by Rude Stockinger, of Manitowoc, Wis.

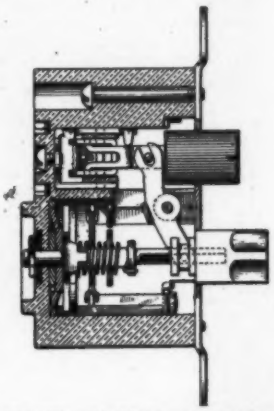
Fixture Canopy (1,270,296).—Instead of fastening the canopy to the piping or stem of the fixture, Aubrey E. Jeune (of Toronto, Ont.) interlocks it by a simple twisting movement with a base ring which is first screwed to the ceiling.

Fuse Device (1,270,335).—The terminals of the socket portion of this device are loosely received within recesses, so that they automatically adjust themselves to the contacts on the plug member. Patented by Edmund O. Schweitzer and Alfred Herz, both of Chicago.

Controlling the Motors of Pneumatics (1,270,382).—For player pianos or the like, John A. Weser drives the air pump by an electric motor and provides automatic means for closing the circuit of the motor when a predetermined time has elapsed after the circuit was opened. He also provides means for adjusting the length of this time interval. The patent was assigned to Weser Bros., Inc., of New York City.

Controlling Humidity (1,270,747).—To control both the temperature and the humidity in a room, Anthony S. Santos (of West Roxbury, Mass.) employs wet and dry-bulb thermometers and a series of contacts for each thermometer. Controllers in circuit with these contacts, and with selective resistances connected to the various contacts, govern coils which in turn control switches for closing circuits arranged for operating valves. The patent was assigned to the Spray Engineering Co., of Boston.

Multi-Circuit Push-Button Switch (1,269,419).—For controlling the several lights of an electrolier separately, Frederick P. Gates mounts the white button of a push-button switch so that it can slide on a stem carrying switch blades which can be brought into connection with the different contacts by rotating this button. Thus, the circuit connections can be



No. 1,269,419.—Multi-Circuit Push-Button Switch.

varied by rotating one button, while the current is switched on or off by the usual push-button movement. The patent was assigned to the Arrow Electric Co., Hartford, Conn.

Dashpot for Measuring Instruments (1,269,519).—As a damper for electric measuring instruments, Adelbert O.

No. 1,269,519.—Dashpot Damping Device for Instruments.

Benecke, of Boston, uses a hollow vane mounted in a box which has its interior so shaped as to form long and narrow air passages between its compartments. The patent was assigned to the General Electric Co.

Men in Service

H. W. Wallace Commissioned Major in Quartermaster's Department—A. W. West Enters Signal Corps—Honor Rolls

R. B. STEWART, formerly instructor in electrical engineering at Sibley College, is now a sergeant at the U. S. S. Radio School, College Park, Md. He has been recommended for a commission of second lieutenant.

A. W. WEST, formerly field engineer but recently foreman in charge of new work at the Dunlap Plant of the Georgia Railway & Power Company, has entered the radio section of the Signal Corps and is at College Park, Md., where he is working for a commission

LIEUT. FULTON MANDEVILLE, formerly of the commercial department of the Louisville Gas & Electric Company, Louisville, Ky., has been promoted to the rank of captain in the 327th Machine Gun Battalion of the Lincoln Division. Captain Mandeville graduated from the officers' training camp at Fort Benjamin Harrison last year and received a commission as First Lieutenant.

LIEUT. HARRY WALTER PRINCE, at the time of his enlistment an engineer with the Birkinbine Engineering Company, was killed while making a practice flight in England on June 11. He entered the aviation service in October, 1917, was sent to the ground school first at Columbus, Ohio, and then to Camp Hicks, Texas. Later he was transferred to Garden City, L. I. He sailed from an American port about seven weeks ago, and his training was to have been completed in an English camp.

LIEUT. L. O. LANGSTON, formerly in the commercial office of the Southern Bell Telephone & Telegraph Company at Atlanta has been cited for bravery on the battle field of France. Lieutenant Langston has for some time been in charge of the telephone and wireless operations of the Catigny sector, and during the recent fight kept up telephone communications at great risk of life.

BUREAU OF ELECTRICAL INSPECTION OF CITY OF CHICAGO reports that the following members of its staff are now engaged in military service: Maj. Samuel R. Todd, Arthur W. Barwig, Warren E. Bostwick, Fred C. Kohfeldt, John P. Ryan, A. J. Walsh, and Francis A. Walsh. Major Todd, formerly electrical inspector of theaters, has been placed in charge of the 306th Field Artillery at Camp Sevier, Greenville, S. C., to complete the training of the soldiers of the national army who are about to be sent abroad for overseas service. Last July Major Todd, then a captain, was ordered to attend the first signal officers' training school at Fort Leavenworth, and upon completing the course was assigned to Camp Grant, where he took charge of his company, then a unit of the 311th Field Signal Artillery. On January 12 he was transferred to Camp Jackson and given command of the 306th which he organized.

ROLL OF HONOR.

The electrical industry, perhaps to a greater extent than any other industry, has answered the call of the Nation for Men. As this is a war of engineers, naturally the technically trained men in the electrical industry have been in great demand and they have responded with splendid patriotism. Many of the large utility and industrial corporations have assigned men for Government service aside from those who have voluntarily entered or been called for service.

THE ELECTRICAL REVIEW *will welcome news concerning men who have entered the service or who are engaged in any patriotic duties.*

FRANKLIN C. WEBBER, of the Southern California Edison Company at Los Angeles, has enlisted as an electrician in the U. S. Naval Reserve.

SERGT. MARTIN J. ROHACEK, a former employee of the Western Electric Company, Hawthorne, Ill., was killed in action July 18, while serving with his unit, Company I, 18th Infantry.

SAM BROWNE, formerly superintendent of the Gainesville district of the Georgia Railway & Power Company, is now a civilian engineer in the employ of the Ordnance Department in Washington

L. J. CRISSMAN, formerly of the New York house of the Western Electric Company, and who has been in the naval training camp for several months, has arrived safely in France, where he will take up active work in wireless operations.

E. C. ARNOLD, formerly in the combustion department of the Denver Gas & Electric Light Company, Denver, Colo., is a first lieutenant in the Signal Corps and is acting as instructor in radio mechanics. Lieutenant Arnold attended the Second Officers' Training Camp at Fort Sheridan, Ill.

H. W. WALLACE, for the past six years vice-president and general manager of the Western Light & Power Company, with headquarters at Boulder, Colo., has resigned and accepted an appointment as major in charge of engineering and construction, Quartermaster's Department, with headquarters at Washington, D. C.

W. G. WILLIAMS, results engineer of the Empire District Electric Company, Joplin, Mo., has received an appointment as engineer in charge of fuel conservation in the mid-continent field by the petroleum division of the United States Fuel Administration for the duration of war. Mr. Williams will have his office in Oklahoma City.

J. R. STEPHENS, toll traffic chief of the Southwestern Bell Telephone System at San Antonio, Tex., has enlisted in the Signal Corps, reporting for duty at Fort Sam Houston, Tex.

FIRST LIEUTENANT W. T. WATERS, formerly advertising manager of the Georgia Railway & Power Company, Atlanta, Ga., has arrived safely overseas. Lieutenant Waters is serving with the Seventy-eighth Field Artillery, a part of the Sixth Division.

A. M. FROMHERZ, formerly engineer for the Dravo Contracting Company, Pittsburgh, Pa., is now in military service. He has been appointed master engineer in the 310th Engineers, which regiment has been ordered for service overseas.

OSCAR VOGEL and H. A. BENSON, of the stores department of the Western Electric Company at Denver, Colo., have just been assigned to military duty. Mr. Vogel is located at Camp Cody, and Mr. Benson is a special student at the training school connected with the State University at Boulder, Colo.

WESTERN ELECTRIC COMPANY, Chicago, has since the publication of the last issue of Western Electric News, added the following names to its roll of honor: L. F. Horn and George W. Stewart, general purchasing department, New York; G. R. Muller, general sales distributing, New York; J. P. Adams, Jr., and J. C. Laurent, Atlanta; Ed. J. Aubrecht, Thomas L. Cutter and W. F. Scheifelbein, Minneapolis; E. F. Lahiae and R. J. Rosmusen, Seattle; A. R. Bice, H. P. Blot, Jr., G. C. Bruns, H. L. Coyne, R. C. Deale, Robert J. Farrell, F. LaCroix, A. Lazar, H. A. O'Neil, O. J. Paulsen, Paul A. Raibourn, C. D. Russell, G. D. Thewlis, J. J. Tracy and H. B. Whitfield, engineering department.

BELL TELEPHONE COMPANY OF PENNSYLVANIA and associated companies has added 40 stars to its service flag, which already contains 997 stars, one of the best records attained by utility companies. Since June 1 the following employees of the company have enlisted in Government service: Arthur A. Beisel, Hugh B. Frey, Walter J. Hodrus, Robert G. Dodds, Clarence A. Staudinger, William F. Eames, Clarence A. Bierman, Jacob S. Brunhouse, Thomas G. Ashby, Milton R. Dunkle, Charles Farwell, Ralph C. Frantz, John F. Gerboth, Harold E. Hartman, Robert M. Klepfer, John W. Miller, Claude M. Northrop, Jesse O. Rutherford, Henry A. Stout, Wallace D. Hiker, Thomas W. Mannix, John L. Smith, Lloyd E. Cook, James E. MacMillin, William M. Richardson, Wesley C. Satterfield, John L. Garrett, Earl F. Maley, Anthony J. Walters, Edw. W. Gabriel, Frederick R. Kirkland, Austin Pierce, Jr., Ross P. Fry, Milton B. Herr, Lee S. Izer, Maurice E. Rulong, Edward H. Trudell, William R. Wallace, Thomas J. Ewing and George Coverly Smith.

Personal

Dana Pierce and M. G. Lloyd Serving on Electrical Committee of N. F. P. A.—J. N. Mahoney Resigns—Changes

DANA PIERCE, who has just been made chairman of the Electrical Committee, National Fire Protection Association, which has charge of the biennial revision of the National Electrical Code, is vice-president and electrical engineer of Underwriters' Laboratories. Having served on the committee some ten years, during which time he has made a most exhaustive study of the Code and the reasons for the various rules and their needed revisions from time to time, Mr. Pierce is exceptionally qualified to serve as chairman of this work. His connection with Underwriters' Laboratories gives him added fitness to direct the maintenance of the Code up to the standards of current practice. Mr. Pierce was born in Claremont, N. H., in 1871 and received his preparatory education in the schools of Newton, Mass. In 1892 he was graduated from Amherst College and subsequently took post-graduate studies at Cornell and Johns Hopkins Universities. From

Dana Pierce.

1900 to 1906 he taught physics and mechanics at Pratt Institute, Brooklyn, N. Y., where he also availed himself of opportunities for further specialization along technical lines. In March, 1906, he became associated with Underwriters' Laboratories as electrical engineer at the chief testing station in Chicago. A few years later he was elected vice-president of the Laboratories, and in 1912 he moved to New York City to establish and take charge of the New York office and electrical testing station of the Laboratories. Mr. Pierce is a member of the Theta Delta Chi and Phi Beta Kappa fraternities and of many technical and engineering societies. He has contributed to scientific and engineering literature and has the faculty of not only writing in an illuminating way but also of being able to express himself extemporaneously in a very clear and instructive manner.

J. E. SHUFF, new business manager of the Lincoln Gas & Electric Light Company, has been re-elected secretary and treasurer of the Nebraska Electrical Association.

J. H. FENTON, of the Los Angeles office of the Westinghouse Electric & Manufacturing Company has recently been appointed manager of the industrial division of that office, which includes jurisdiction over the Tucson and El Paso offices.

C. J. PETERSON, who has been connected with the Stillwater, Minn., division of the Northern States Power Company for eight years as hydroelectric superintendent, has been appointed general superintendent, succeeding C. J. Carey.

FRANK W. LAAS has been appointed superintendent of the Western Light & Power Company, with headquarters at Boulder, Colo. Mr. Laas was formerly superintendent of power of the Iowa Railway & Light Company, Iowa Falls and Iowa Electric Company, Cedar Rapids, Iowa.

JOHN W. BROOKS, general manager of the Pass & Seymour Company, Solvay, N. Y., manufacturer of electrical specialties, has been appointed a member of the new Community Labor Board for the Tenth District. The Board, which is now being organized, is formed chiefly for the purpose of handling labor problems which may arise during the period of the war.

PAUL P. HAYNES, member of the Indiana Public Service Commission has been appointed a member of the special war committee of the National Association of Railway and Utility Commissioners, with headquarters in New York City. Mr. Haynes succeeds Max Thelen, chairman of the California Railroad Commission, who has resigned to become surveyor of contracts in the war department.

J. N. MAHONEY, for 12 years a member of the engineering department, has tendered his resignation from the Westinghouse Electric & Manufacturing Company, to open consulting offices in New York. For the last eight years, Mr. Mahoney has been in charge of designing switches, fuses, and circuit breakers for the Westinghouse company and is largely responsible for the progress that has been made in this class of apparatus. Previous to this work he was connected with the railway engineering department in charge of control design. Mr. Mahoney is a member of the American Society of Mechanical Engineers, American Society of Mining Engineers, American Institute of Electrical Engineers, and the American Electrochemical Society, and his wide acquaintanceship and broad experience in electrical work should be of great assistance to him in his new field.

MORTON G. LLOYD, electrical engineer in charge of safety work in the Bureau of Standards, Washington, D. C., has been appointed a member of the Electrical Committee of the National Fire Protection Association, to represent the Bureau of Standards. After being graduated from the Central Manual Training School in Philadelphia, Dr. Lloyd took the electrical engineering course at the University of Pennsylvania, and was graduated with honors from that institution. The University of Pennsylvania has conferred upon him the scientific and technical degrees of Bachelor of Science, Doctor of Philosophy, and Electrical Engineer. He was appointed Hector Tyndale fellow in physics, and for three years pursued graduate studies in physics, mathematics and chemistry at Pennsylvania, Harvard and Berlin Universities. Dr. Lloyd was instructor at University of Pennsylvania from 1899 to 1902, at which time he was appointed laboratory assistant at the Bureau of Standards, Washington, and later

Morton G. Lloyd.

steadily promoted to associate physicist in charge of the magnetic testing. From 1910 to 1917 he was technical editor of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, and in the latter year returned to the Bureau, and upon the resignation of W. J. Canada was placed in charge of electrical safety engineering. He is a fellow of the American Institute of Electrical Engineers and has served upon its Standards Committee and various other committees. He is vice-president of the Illuminating Engineering Society and a member of its Committee on Lighting Legislation; a few years ago he was chairman of its Chicago Section. He is a member of the Divisional Committee on Lighting of the Advisory Commission of the Council of National Defense, also the American Association for Labor Legislation and of other scientific and technical societies.

Financial News

Plans to Relieve Needy Utility Companies.

A series of conferences, attended by bankers and the managing directors of many large public utility properties, will consider the problem of providing financial relief to needy utility companies which are unable to borrow from their banks, cannot sell securities on a sane basis in the market, and are denied relief by the War Finance Corporation.

One of the schemes generally favored is the formation of a series of financing corporations, one in each center, where money in any large amount is to be provided, the corporation formed to loan needed funds to the utility and in turn rediscounted with the War Finance Corporation the notes of the borrowing utility.

Duquesne Light Sells Notes.

The Duquesne Light Company has sold $10,000,000 of three-year 6 per cent secured notes to the Harris Trust & Savings Bank of Chicago, and Ladenburg, Thalmann & Company, the First National Bank and the Chase National Bank of New York. The Duquesne Light Company does the entire central station electric light and power business in the city of Pittsburgh and the major part of Allegheny and Beaver counties, Pennsylvania. Properties operated by the company and subsidiaries serve a total population estimated at 1,100,000. Franchises with minor exceptions are in the opinion of counsel unlimited in time, or for 999 year periods. The issue has been favorably passed upon by the Capital Issues Committee and the notes, due July 1, 1921, will be offered to the public at 96 and interest, yielding over 7½ per cent.

Westinghouse Electric Sales Expand.

It is reported that for the three months ended June 30 the Westinghouse Electric & Manufacturing Company billed out sales approximating $33,000,000, which is an increase of about 50 per cent over the sales for the corresponding period of 1917, amounting to about $22,000,000. If the same percentage of increase is maintained for the remaining three quarters the company would close the year with gross sales of more than $140,000,000, compared with $95,735,000 for the year ending March 31 last. During the quarter new orders came in at a rate practically equal to the sales billed. Therefore, the value of unfilled orders on hand June 30 shows but little variation from the $147,857,000 of business booked March 31. This $147,857,000 on March 31 consisted of $110,185,000 for the regular products and $37,672,000 for munitions. It is understood that the orders as of June 30 were segregated in about the same proportions.

Interborough Rapid Transit Note Issue Authorized.

The Interborough Rapid Transit Company, 165 Broadway, New York City, has been granted permission by the Public Service Commission to issue 7 per cent notes for $39,416,000, to be used, in part, as follows: For the erection of new additions and the installation of new equipment, etc., to its power plants, $20,229,762; for construction of additional trackage facilities for elevated systems, $11,771,387; for extensions in its elevated systems, $3,250,131, and improvements in transmission systems, alterations and improvements in existing power plants, substations, etc., $2,391,000.

Offer Kansas City Railways Notes.

The $7,750,000 Kansas City Railways Company three-year 7 per cent collateral gold notes, maturing May 15, 1921, recently purchased by Halsey, Stuart & Co., the Continental & Commercial Trust & Savings Bank and the Union Trust Company, of Chicago, and the New England National Bank of Kansas City, are being offered to the public at 98 and interest, yielding more than 7.75. The collateral consists of $10,134,000 of the company's first mortgage 6 per cent bonds, due in 1944.

New York Utility Financing Approved.

The Public Service Commission of New York has approved the application of the Syracuse & Suburban Railroad Company for permission to make a first refunding mortgage on all the company's property for $1,000,000 and for authority to issue $750,000 in fifty year 5 per cent bonds. Proceeds of the bonds are to be used in purchasing outstanding bonds and for reimbursing the company's treasury for capital expenditures made and under contemplation.

United Light & Railways Notes Offered.

Bonbright & Company, New York, Boston, Philadelphia and Chicago, are offering a new issue of 7 per cent bond secured gold notes of the United Light & Railways Company, the total issue being $1,250,000. The notes are dated April 1, 1918, and are due April 1, 1923, and their purpose is to reimburse the company for extensions, additions and improvements to property. This company operates twenty-one public utility properties which supply without competition fifty-five communities having an estimated population of 575,000. These communities are in Iowa, Illinois, Indiana, Michigan and Tennessee.

Philadelphia Electric Bonds.

Harris, Forbes & Company are offering $1,500,000 Philadelphia Electric Company first mortgage sinking fund 5 per cent gold bonds, due in 1966, at 93 and interest. The bonds are free of the Pennsylvania state tax; and, of the present 4 per cent normal Federal income tax, the company pays the 2 per cent tax deductible at the source. The bonds are callable as a whole or in part at 110 and interest, on October 1, 1921, or on any interest date thereafter. For purposes of the sinking fund, they are callable at 105 and interest on every October 1, beginning in 1921. The $24,987,750 capital stock of the company has a present market value of about $24,500,000, and dividends have been paid without interruption during the past 15 years on the capital stock from time to time outstanding, the dividend for the last four calendar years having been at the present rate of 7 per cent per annum.

New Orleans Railway & Light to Issue Notes.

D. D. Curran, president of New Orleans Railway & Light Company, has addressed a letter to holders of the company's two-year 6 per cent gold debentures which matured June 1 last, advising them that directors have authorized an issue of $4,000,000 of one-year 7 per cent notes, dated June 1, 1918, callable at 100 and interest on 30 days notice. These notes are for the purpose of refunding the 6 per cent debentures which mature June 1, 1918, of an equal amount. Holders are requested to deposit notes with the Central Trust Company of New York or the Pennsylvania Company. For insurance on lives and granting annuities of Philadelphia, notes to be exchanged on an equal basis. The mortgage covering the issue of notes will provide for an additional amount of $1,500,000 if necessary, to take care of expenditures already made and to be made.

The company made application to the War Finance Corporation for assistance in taking care of this maturity and considerable interest was taken in the decision of the Federal organization which denied its application, calling attention to the fact that "resources of the War Finance Corporation are not intended to be loaned directly to war industries, but only indirectly through the banks." Following the decision of the Finance Corporation, the company immediately appealed to the municipal authorities of New Orleans for an advance in rates to cover increased operating cost, and as a result of these negotiations the city of New Orleans has entered into an agreement with the company whereby the Mayor, the Commissioner of Public Utilities and the Commissioner of Public Property have become members of the board to insure co-operation.

Pacific Gas and Electric Income Shows Improvement.

Net income of the Pacific Gas & Electric Company for the year ending June 30, 1918, was $7,408,883.99, or a decrease of $642,133.19 from the previous year.

Net income for the six months to June 30, 1918, also shows a decrease of $58,153.39. Net income for the month of June was $783,751.56, or increase over the same month last year of $36,697.74.

The report follows:

Month of June.

	1918.
Gross revenue	$ 1,860,815
Expenses	1,117,284
Net	$ 743,530
Miscellaneous income	40,250
Total net income	$ 783,781
Deductions—	
Interest	$ 343,555
Bond discount and expense	15,246
Dividend on preferred	124,252
Total deductions	$ 483,233
Balance	300,548

Six Months Ended June 30.

	1918.
Gross revenue	$10,610,305
Expenses, etc.	6,881,918
Net earnings	$ 3,728,387
Miscellaneous income	235,372
Total net income	$ 3,963,759
Deductions—	
Interest	$ 2,062,455
Bond discount and expense	92,558
Dividend on preferred	745,128
Total deductions	$ 2,900,142
Balance	1,063,617

Twelve Months Ended June 30.

	1918.
Gross revenue	$20,613,258
Expenses, etc.	13,706,733
Net earnings	$ 6,906,525
Miscellaneous income	502,358
Total net income	$ 7,408,883
Deductions—	
Interest	$ 4,130,012
Bond discount and expense	185,116
Dividend on preferred	1,487,991
Total deductions	$ 5,803,120
Balance	1,605,763

Earnings.

UNITED GAS & ELECTRIC COMPANY.
(Subsidiaries.)

For the year ended June 30—Gross, $16,342,825, increase $572,203; net, after taxes, $5,129,540, decrease $1,275,031; balance, after fixed charges, $1,405,003, decrease $1,512,308; renewals and replacements, $404,750, decrease $363,675; preferred dividends, $705,206, decrease $5,631; surplus applicable to common stock of subsidiary companies, $296,046, decrease $1,142,002. For June (subsidiary operating companies)—Gross, $1,322,968, increase, $45,123; net after taxes, $390,595, decrease $123,668; fixed charges, $305,726, increase $30,630; balance for reserve, replacements, dividends, $86,869, decrease $154,298.

THE GENERAL GAS AND ELECTRIC COMPANY.
(Subsidiaries.)

Statement of estimated gross revenue for the month of July, 1917 and 1918, and comparisons:

	1918.	1917.
Rutland system	$ 42,513.27	$ 41,600.67
Northwestern Ohio system	40,000.00	28,781.43
Sandusky system	32,262.28	30,674.18
Binghamton system.	32,697.49	27,734.28
Sayre system	10,004.53	7,973.97
New Jersey system.	24,387.30	18,771.81
Interurban Gas Company	1,171.71	996.46
Totals	$183,036.58	$156,532.80

AMERICAN LIGHT & POWER.

For the twelve months to June 30 (controlled companies)—Gross, $12,258,293, increase $1,415,611; net, $4,995,826, increase $260,517. June gross, $1,029,205, increase $168,940; net, $416,159, increase $49,751.

MANUFACTURERS' LIGHT & HEAT.

For the six months to June 30—Gross, $4,938,271, increase $529,569; net, $2,085,714, increase $237,316; total income, $2,116,733, increase $232,672; bond interest, etc., $31,507, decrease $4,123; sundry adjustments, $34,821, decrease $1,457; dividends, $920,000, decrease $460,000; surplus, $1,130,405, increase $698,253.

COMMONWEALTH POWER RAILWAY & LIGHT.

For June—	1918.
Gross earnings	$1,831,428
Net earnings	786,455
Fixed charges	623,427
Net profits	163,028
Preferred dividend	89,765
Balance available for replacement and dividend on common	73,263

H. M. BYLLESBY PROPERTIES.

Gross and net earnings of combined Byllesby properties for the month of July, 1918, and for the year ended July 31, 1918, compared with the corresponding previous periods, are as follows:

Month of July—	1918.	1917.
Gross earnings	$ 1,712,473	$ 1,465,313
Net earnings	676,769	652,412
Year ended July 31—		
Gross earnings	21,036,672	18,137,161
Net earnings	8,585,959	8,558,587

POSTAL TELEGRAPH.

The Postal Telegraph Cable Company of New York reports for May:	
Gross revenue	$186,930
Operating deficit	13,324
From January 1 to May 31—	
Gross revenue	920,503
Operating deficit	24,327

EASTERN POWER & LIGHT CORPORATION.

(Subsidiaries.)

Statement of estimated gross revenue for the month of July, 1917 and 1918, and comparisons:

	1918.	1917.
Reading system	$330,740.22	$272,625.52
Pennsylvania utilities	128,033.64	88,237.87
West Virginia system	100,003.44	82,117.82
Claremont system	29,845.20	24,319.12
Totals	$588,622.50	$467,300.33

SOUTHERN POWER & LIGHT.

Earnings of the subsidiary companies for June:

	1918.
Gross earnings	$ 415,586
Net earnings	166,002
For 12 months ended June 30—	
Gross earnings	5,067,386
Net earnings	2,065,256

MISSISSIPPI RIVER POWER COMPANY.

For June—	1918.
Gross earnings	$ 182,590
Net earnings	149,586
Surplus after charges	29,324
For 12 months ended June 30—	
Gross earnings	2,115,033
Net earnings	1,705,710
Surplus after charges	254,487

STONE & WEBSTER PROPERTIES.

According to 12 months' earning report just issued by Stone & Webster for public utility properties managed by them, four of their biggest earners all showed improvement over the 12 months ended with June, 1917. This applies to gross for all four, and to both net and surplus after charges for three. Thus, Galveston-Houston Electric Company for 12 months ended June 30, shows gross of $2,385,000, an increase of $425,000, and surplus, after charges, of $365,000, an increase of $133,000; Mississippi River Power Company, gross, $2,115,000, increase $272,000; surplus, $254,000, increase $70,000; Northern Texas Electric Company, gross, $3,078,000, increase $990,000; surplus, $1,074,000, increase 0562,000; the Blackstone Valley Gas & Electric Company, operating in Rhode Island, shows gross of $2,168,000, increase $324,000; but surplus of $397,000 is a decrease of $51,000. The biggest Stone & Webster property—the Puget Sound Traction, Light & Power Company, reporting for 12 months ended May 31 last, shows gross, $10,329,000, increase $1,640,000; surplus, after charges, $1,456,000, increase $314,00.

DUQUESNE LIGHT COMPANY.

The consolidated income account of the Duquesne Light Company, for the fiscal year ended March 31, 1918, compares as follows:

	1918.	1917.	1916.
Gross earnings	$9,842,394	$7,310,704	$5,368,025
Balance after expenses and taxes	2,709,582	2,990,261	2,695,151
Other income	102,571	112,246	224,386
Total income	$2,812,153	$3,102,507	$2,919,537
Surplus after charges	1,644,296	2,168,327	1,614,487
Preferred dividends	414,503	397,466	205,702
Common dividends	1,457,969	1,456,172	1,264,706
Deficit	$ 228,176	*$ 314,689	*$ 144,079

*Surplus.

DETROIT EDISON COMPANY.

(Including All Constituent Companies.)

Consolidated comparative earnings and income statement:

	Month of June, 1918.	Month of June, 1917.	6 months of 1918.	6 months of 1917.
Operating revenue—				
Commercial electric revenue	$ 876,697.24	$ 732,351.10	$5,408,598.38	$4,787,334.83
Municipal electric revenue	26,025.38	22,040.39	156,088.04	125,460.74
Sales to street railways	70,442.76	70,340.29	423,128.72	385,094.87
Sales to other public services corporations	11,419.71	10,625.59	73,962.37	67,720.93
Miscellaneous revenue	864.00	1,250.20	21,052.31	12,563.34
Non-operating revenue—				
Steam sales	12,482.06	16,410.22	529,493.86	529,568.93
Other non-operative revenue	13,688.48	15,751.47	80,509.03	89,760.59
Total gross revenue	$1,011,619.63	$ 868,769.26	$6,692,832.71	$5,997,504.23
Expenses—				
Operating and non-operating (except renewals, replacement and contingent)	$ 694,708.55	$ 577,291.51	$4,485,413.54	$3,677,125.32
Renewal, replacement and contingent (depreciation reserve)	60,730.00	60,730.00	352,005.00	352,005.30
Total operating and non-operating expenses	$ 755,438.55	$ 638,021.51	$4,837,418.54	$4,029,130.32
Net income	$ 256,181.08	$ 230,747.75	$1,855,414.17	$1,968,373.91
Deductions from income—				
Interest on funded and unfunded debt	$ 106,480.99	$ 84,255.07	$ 604,778.64	$ 508,056.29
Other deductions				
Total deductions	$ 106,480.99	$ 84,255.07	$ 604,778.64	$ 508,056.29
Net	$ 149,700.09	$ 146,492.68	$1,250,635.53	$1,460,317.62

WEEKLY COMPARISONS OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

Public Utilities—	Div. rate. Per cent.	Bid Aug. 6.	Bid Aug. 13.
Adirondack Electric Power of Glens Falls, common	6	15	14
Adirondack Electric Power of Glens Falls, preferred	6	68	68
American Gas & Electric of New York, common	10+extra	81	81
American Gas & Electric of New York, preferred	6	37	37
American Light & Traction of New York, common	..	183	187
American Light & Traction of New York, preferred	6	90	91
American Power & Light of New York, common	4	40	40
American Power & Light of New York, preferred	6	66	65
American Public Utilities of Grand Rapids, common	..	..	..
American Public Utilities of Grand Rapids, preferred	6	..	..
American Telephone & Telegraph of New York	..	92	91¾
American Water Works & Elec. of New York, common	..	4½	4½
American Water Works & Elec. of New York, particip	7	12	12
American Water Works & Elec. of New York, first preferred	..	55	55
Appalachian Power, common	..	3	3
Appalachian Power, preferred	7	20	20
Cities Service of New York, common	+extra	207	210
Cities Service of New York, preferred	6	74	74
Commonwealth Edison of Chicago	8	100	100
Comm. Power, Railway & Light of Jackson, common	..	22½	22
Comm. Fower, Railway & Light of Jackson, preferred	6	41	41
Federal Light & Traction of New York, common	..	7½	7½
Federal Light & Traction of New York, preferred	..	35	35
Illinois Northern Utilities of Dixon	6	..	..
Middle West Utilities of Chicago, common	2+extra	10	17
Middle West Utilities of Chicago, preferred	6	37	37
Northern States Power of Chicago, common	..	42	44
Northern States Power of Chicago, preferred	ex.div.7	79	79
Pacific Gas & Electric of San Francisco, common	..	34	34½
Pacific Gas & Electric of San Francisco, preferred	6	79	79
Public Service of Northern Illinois, Chicago, common	7	72	75
Public Service of Northern Illinois, Chicago, preferred	6	82	85
Republic Railway & Light of Youngstown, common	4	20	20½
Republic Railway & Light of Youngstown, preferred	6	59¼	59
Standard Gas & Electric of Chicago, common	..	4	4½
Standard Gas & Electric of Chicago, preferred	6	21½	23
Tennessee Railway, Light & Power of Chattanooga, common	..	3	3
Tennessee Railway, Light & Power of Chattanooga, preferred	6	14	12½
United Light & Railways of Grand Rapids, common	4	30	29
United Light & Railways of Grand Rapids, preferred	6	60½	61
Western Power of San Francisco, common	..	13	12
Western Power of San Francisco, preferred	6	50	48
Western Union Telegraph of New York	extra	79	77½
Industrials—			
Electric Storage of Philadelphia, common	4	50	54½
General Electric of Schenectady	8	144	146
Westinghouse Electric & Mfg. of Pittsburgh, common	7	42	42¼
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	58	58

*Last sale.